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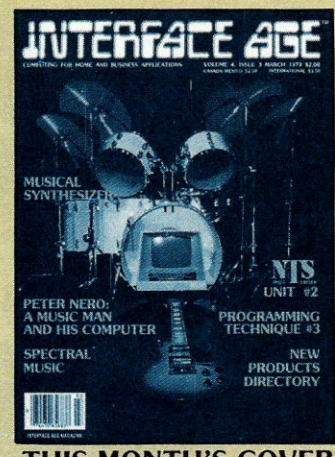
CIRCLE INQUIRY NO. 8

VOL. 4, ISSUE 3
SINCE DECEMBER 1975

MARCH 1979

INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS



THIS MONTH'S COVER

Designed by Fino Ortiz, Art Director; photography by Don May. Guitar furnished courtesy of Richard Ortiz. Drums supplied by Studio Instrument Rentals, Hollywood, California.

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CIRCLE INQUIRY NO. 2

EDITOR'S NOTEBOOK

IT'S SHOW TIME AGAIN

The show season is just beginning to start and start it did this January with the Consumer Electronics Show in Las Vegas. This show hosted over 45,000 buyers, retailers, and manufacturers who were anxious to see the '79 electronic industry entrants.

The exciting part of this show is that just about every electronic device related to the consumer was displayed, including the new computer entries from Atari, Bally and, most significantly, Mattel.

Only two manufacturers familiar to the micro industry were present, Apple and Ohio Scientific. Their presence indicated to me that both are extremely serious about providing products aimed directly at the general consumer.

GRT was also present and announced their line of software products for the TRS-80, Apple and Sorcerer lines. GRT is extremely excited about the prospects open to them with their software packages and foresees a banner year in store.

The show did present a very positive picture of a healthy industry even with the prospects of major economic disruptions on the horizon.

MORE ON THE ECONOMY

Last month, I began talking about the economy as I saw it, and the problems that exist. Rather than to dig a hole that I would be unable to crawl out of, I decided that I should contact an authority on the subject.

I was able to contact Eliot Janeway, the country's most authoritative and outspoken economist. Mr. Janeway filled me in on some facts that are important to know when trying to evaluate what is happening in the world of economics.

Regarding recessions, according to Janeway, they are self curing, the longer they last the sooner they are over. He told me that a bet on a recession was a bet on the recuperative and self-curing powers of the system.

During the course of our conversation, we both agreed that one of the major problems today is that too many individuals and companies owe too much money. In the case of individuals, they know what their payments are but have no idea of the actual debt load, and as a consequence we are seeing unprecedented credit defaults.

Last month, I mentioned that a recession is marked by a rise in the cost of energy, but according to Janeway I have it backwards. His thesis is that recessions are marked by declines in the cost of energy while depressions are marked by rising costs in energy, and a depression in his opinion is a very real danger.

Janeway also felt that an under capitalized company just going into business would be dead, since it is important to have cash to take advantage of bargains and avoid buying expensive cash, either from venture capitalists or commercial lending institutions. This I felt was very significant, since I am predicting that by the time you read this column the prime interest rate will have risen to 14%, with the distinct possibility of going to 16% by the start of the fourth quarter.

Because the economy plays such an important part in our daily lives, we have decided that you as an INTERFACE AGE reader deserve to have your questions answered by a top authority. Therefore, beginning immediately, we will have a new column called "Ask Mr. Janeway." This feature will be used as a forum for Janeway to explain what is happening and to answer your questions. We would like you to ask questions related to the computer industry and the economy in general. One question per letter please. Differing opinions are accepted and will either by answered in the Janeway column or the Letters to the Editor, whichever is appropriate.

To take advantage of this service, write to: Ask Mr. Janeway, P.O. Box 1234, Cerritos, CA 90701. All letters will be forwarded to Mr. Janeway, and your answer will appear in the next possible issue.

—carl

INTRODUCING G2 LEVEL III BASIC.

Now do more than ever before with the most powerful Basic you can buy for the TRS-80.

Open the manual and load the cassette. Then get ready to work with the most powerful Basic interpreter you've ever had your hands on...Level III Basic for Radio Shack Computers. It loads right on top of the Level II ROM, and in just 5K of space, opens up your capability to new dimensions. For starters, this new cassette-based interpreter gives you the whole catalog of disk programming power. Plus graphics commands. Plus powerful editing commands. Plus long error messages, hex and octal constants and conversions, user defined functions and a number of commands never before available on either cassette or disk interpreters!

Easier Loading, Fewer Keyboard Errors. G2 Level III Basic eliminates aggravations you've had, including keyboard "bounce" and those super-sensitive tape deck settings. Programs will load easier, and you'll have far less trouble with input errors.

Basic Access to RS-232. Until now, if you wanted to access your RS-232 interface, you had to work in assembly language. G2 Level III Basic does the work for you, letting you use your interface with Basic statements.

Have You Wished for More Power? This new interpreter gives you 10 machine language user calls for subroutines, long error messages, a new TIME$ call for your real time accessory, plus measure or limit input timing that lets you put a time limit on responses when you're playing games or giving exams. And the list doesn't stop here.

Easier and More Powerful Graphics. This new Basic includes three simple commands that can eliminate dozens of program steps. PUT transfers information from a designated array to your screen; GET reverses the process. LINE makes your computer do the work when you input beginning and end points. Give it two diagonally opposite corner locations, and it'll outline the rectangle you're looking for.

Only Microsoft Could Do It. G2 Level III Basic was created by Microsoft, the same company that wrote Level II Basic for Radio Shack. And it actually uses Level II as a foundation for this enhanced add-on. By the time you've mastered all it can do, calling up the flexibility of the graphics commands, and even enjoying the convenience of renumbering, you'll wonder how it was all possible. It's like getting a whole new computer for your computer.

Available Now for Only $49.95. You get the power that might otherwise cost you hundreds of dollars in additional equipment for only $49.95. Price includes the User Manual, a Quick-Reference Card, and a preprogrammed cassette tape. Load the tape, open the manual, and get ready to work with the most powerful Basic Interpreter you've ever had your hands on. G2 Level III Basic for the TRS-80. Another member of the growing G2 Personal Computer Program Library.

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LETTERS TO THE EDITOR

IAPS AND COMMENTS

Dear Editor:

First, I would like to compliment you on your efforts with the magazine. It seems to continually improve and become even more worthwhile. I hope your level of success reflects your effort.

Second, I read your IAPS update in the November 1978 issue. Does the material reflect major changes in the various programs you published some time ago relating to the conversions, etc. from IAPS format to a machine usable format? I have not had the opportunity to work with the IAPS format as yet.

Third, a general comment concerning published programs. You may cover this problem in your publication ground rules, but it is not necessarily reflected in the published material.

I believe that each published program should include the machine make, processor and the particular Assembler or BASIC being used. I realize that conversion effort is required, but I find that some software is not really worth the effort. It is not the program that is not worthwhile, but some of the techniques available on some systems are a real battle on others.

John E. Breden
Richardson, TX

John, the IAPS Notebook reflected more definition in IAPS and not major changes. On loading, the information is in machine readable format. Regarding programs, we do try to indicate the machine configuration and version of BASIC used.

GARFINKEL QUESTION ANSWERED

Dear Editor:

This letter is in response to the query by Simson Garfinkel, (November '78, Letters to the Editor) on a 256x256 point graphics display system.

Dear Mr. Garfinkel:

The system you refer to is called the MATROX ALT-256**2 Graphic Display Interface, manufactured by Matrox Electronic Systems, of Montreal, Quebec, Canada.

You may obtain the information you seek from one of their franchised distributors, or by writing them in Montreal. The last address I have for them (and I have no reason to suspect they have moved), is:

Matrox Electronic Systems, Ltd.
P.O. Box 56, Ahuntsic Station
Montreal, Quebec, Canada
H3L 3N5

With this address is the telephone number (514) 481-6838 and a Telex number of 05 825651.

I hope this helps you in getting the data on the graphic system and should be helpful to anyone looking for a dense graphic system that can be ganged (multi-board hookup) to create dense color graphics.

Lew Pitcher
Downsview, Ontario, Canada

Lew, thanks much. Hopefully other readers will be able to use the information.

AN EMPIRICAL APPROACH

Dear Editor:

Many computer users are unable to take advantage of available software that would run on their equipment, because the media on which the software is distributed is not compatible with their own system. I recently purchased the source of Osborne & Associates' payroll package. It was delivered on a single density IBM 3740 formatted diskette. Fine, I had no trouble using it on an IMSAI VDP 80.

However, I also had a requirement to use the package on an OSI Challenger III plus I wanted to modify the programs to run on my own SWTPC 6800 with an MSI floppy. The OSI and MSI formats are each unique and not compatible with the IBM 3740 format.

To solve the problem, I transferred the program from the diskette to an audio cassette via an SWTPC AC-30 cassette interface plugged into the VDP 80's serial port. I used the CP/M PIP transient to make the transfer. I now have the entire (39 programs) payroll source on cassette in Kansas City Standard Format. It could not be loaded into any system with a 300 baud RS 232 port.

I also wanted to use some programs that were in object code form. I had trouble working with this type of file and got around this problem by writing a program to read the object file and output an ASCII HEX file in Intel format.

William Burlingame
Cambridge, OH

A HAPPY CUSTOMER

Dear Tandy Corporation:

Fantastic! That one word best describes the TRS-80. I felt compelled to convey to you how I feel about Radio Shack's microcomputer.

With each piece of hardware I have received, I have become totally engrossed in exploring its particular features and capabilities. The Level-I TRS-80 and user's manual captured me, keeping me up into the early hours of the morning for several days.

The conversion of my computer to Level-II set off a new time of intense study and involvement. I believe that the editing feature alone is worth the cost of the Level-II option. Also, the keyboard feel is great for rapid typing. The interface has allowed me to expand to the line printer and the disk. The printer has proved invaluable in outputting computer results and programs for study and editing.

Finally, the disk with the 2.1 version of the disk operating system is unbelievably great. The rapid storage and recall of programs and data on file has increased my computer's capabilities many, many times.

I had no previous computer experience whatsoever before getting my TRS-80 in January 1978. I have taken the guidance of your easily understood user's manuals along with helpful hints and assistance pro-

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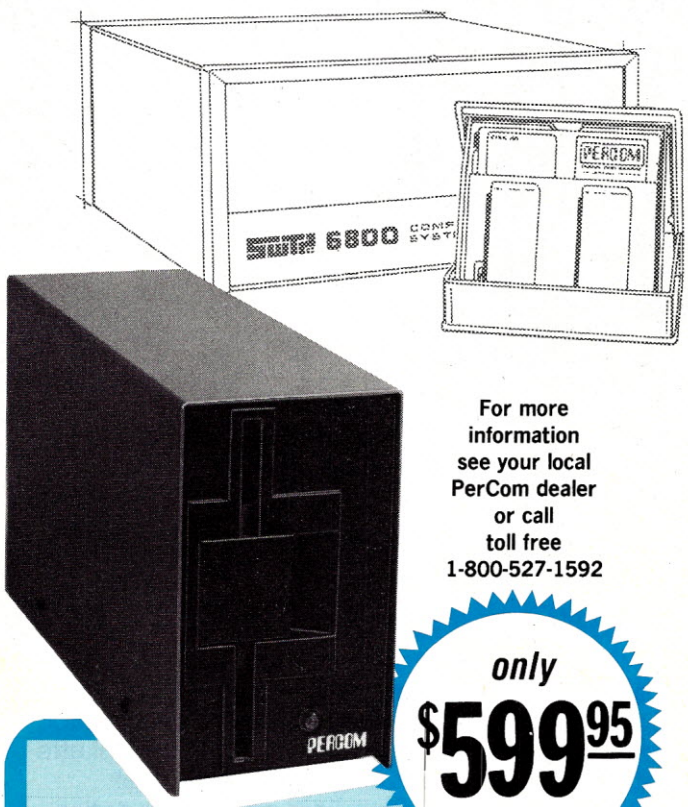

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TOUCHUP™ Modifies TSC's Text Editor and Text Processor for PerCom disk operation. ROLL function permits text files larger than available RAM to be created and edited. Supplied on diskette complete with source listing $17.95

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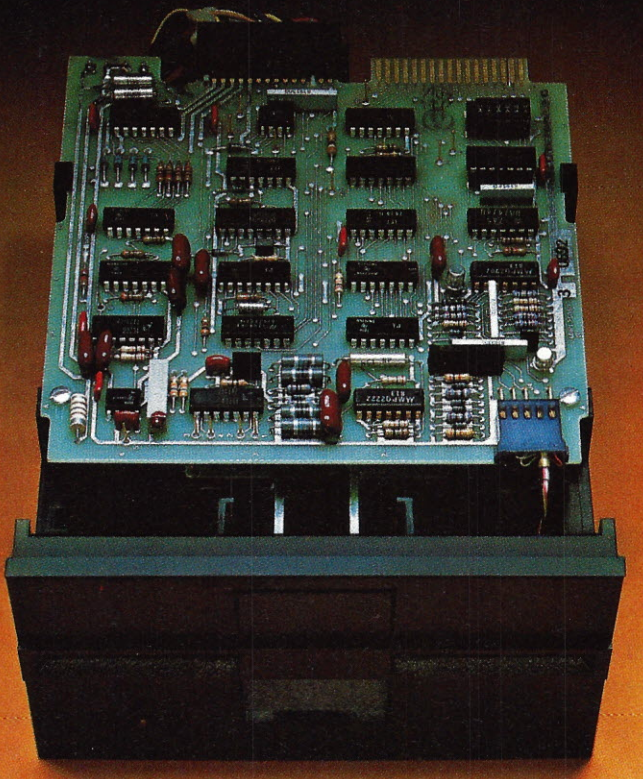

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See opposite page for list of manufacturers featuring Shugart's minifloppy in their systems.

TM minifloppy is a registered trademark of Shugart Associates

vided in microcomputer magazines to be able now to program the computer to get useful and interesting output.

There was recently announced in Mobile a Stock Market Game sponsored by WKRG (a radio station) and put on with the assistance of Merrill Lynch, Pierce, Fenner and Smith and Merchant's National Bank.

The object of the contest was to pick from a set list of 100 common stocks a selection of 10 of these that would increase the most in value in a set time period. I designed a program that would allow me (1) to save, change, and retrieve the closing stock prices for any of the 100 stocks, (2) to calculate the dollar change for any particular set of 10 stocks, (3) to get the closing prices for any of the stocks for all contest days, (4) to get the best to worst dollar performance of the stocks, and finally (5) to get the dollar changes for a number of contestants with 10 stocks each, to rank the contestants according to dollar change, and to rank the contestants according to percentage change. I am using this last capability to give daily contest results to the brokerage concern about their employees' picks and relative rankings within their group.

I do not profess to believe that my TRS-80 can rival a bank computer in running this contest, but it has done the same operations and then some very effectively and impressively.

I wish to thank you for introducing on such a wide and affordable scale the TRS-80 and the world of personal computing.

John J. Armstrong
Mobile, AL

IN THE OTHER AMERICA

Dear Editor:

I am reading your magazine with great pleasure and I am looking forward to buying a complete home computer system but I cannot make up my mind since there are so many fine products available, at least on the American market.

With the coming up of a new generation of 16-bit microprocessors, the performance will still improve a lot from the well-established 8-bit micro. Nevertheless, in the mean time, I try to keep well informed on what is going on in the microcomputer field and made use of the "Reader Service Card" for last October.

I would like to comment on Mr. Ronald J. Subler's letter in "Letters to the Editor" column in the September issue last year, about price differences between Europe and U.S.A. What about that, the last time I was in Sao Paulo, I saw a TRS-80 Radio Shack system (Video, CPU, keyboard, cassette recorder, 16K RAM) for sale at the astonishing price of 180,000 Cruzeiros, more or less $9,000 U.S., ten times the American price.

Jacques Labis
432, Rua Armindo CHAVES, Aº 503
30.000 Belo Horizonte, BRASIL

OK, industry, here's your chance to develop a new market. See how many of you can help Mr. Labis.

VALIDITY CORPORATION HELPS MR. PARRIS

Dear Editor:

In answer to Mr. Jesse D. Parris, December 1978 issue, Validity Corporation of San Diego, California, is developing S-100 bus compatible interfaces and associated software. Among other things, a hard disk system is being developed. The interface, with CP/M compatible software, is presently operational using a Datum controller and Diablo disk with a Cromemco ZPU based microcomputer.

Present software limits disk storage to approximately 10 percent of full capacity; however, software for the complete DOS is planned by mid-April. It is planned to make the DOS (interface and software) available at that time.

Prices are not yet firm, but should be between $1,000-$1,200 for the package. Hope this helps Mr. Parris.

W.F. Pittman, Jr., President
Validity Corporation
San Diego, CA

WHERE TO GET IT

Dear Editor:

In the Index to Software as published in the November 1978 issue, under published software referenced is "Basic Software Library, Vol. 1." I would very much appreciate any information you could furnish regarding where these books can be obtained.

Thanks for an outstanding publication. Keep up the good work.

Dan Gryder
Inverness-Shire, Scotland

Dan, this series can be ordered from Scientific Research Instruments, P.O. Box 490099-1, Key Biscayne, FL 33149. See our December 1978 issue for other books and addresses.

A READER COMMENTS

Dear Editor:

Fantastic! I want to congratulate you for printing the ham radio article. I refer to Bill Hunsicker's article on control and identity programming for running a repeater. It gives one some good ideas even if you can't use it directly (I use a Z-80, for instance, and to have used this one would have helped many more). Maybe eventually I'll learn how to convert such programs. More articles like this will help hams into microcomputing.

A second Kudo for the article on acoustic coupled modems. I want to get one hooked up so I can get into the various CBBSs (Computer Bulletin Board Systems). I think you could well afford to print an article on these systems. We have one here in San Diego now and there are others in Santa Clara, Chicago and Atlanta, and I've heard that another is now on somewhere else, maybe L.A.?

The NTS course series is another excellent thing to implement. However, I have two comments.

First, each installment should be complete and not carried over to the next month. Se-

cond, many, like myself know the basics and only need the computer applicable lessons. It will probably be lesson #5 before I get anything significant from it and that is quite a long time to wait. I realize the wide range you have to appeal to and I think it is really great you are presenting it at all.

You gave three companies a nice plug for their being good ones to do business with. I would like to make a comment about another company that deserves some praise. It's American Used Computers/ Computer Warehouse in Boston. I got my Diablo from them and besides always being prompt and responsive or letting me know why, they sent me a letter thanking me for my business and it was signed by the top five officials of the company from the President on down. And they are real signatures done in red, green and blue ink.

Lon Allbright
San Diego, CA

Lon, the NTS Series is planned to run complete in any given month. However, Unit 1 contained so much information we needed to spread it out over two months. During the next several months we will be adding two additional tutorials which we think everyone will enjoy.

MORE DEFINITIONS

Dear Editor:

Your letter from John Beetem in the December '78 issue jogged a thought concerning the proper designation for those of us who operate calculating and processing engines. I think that the form is grammatically correct and that the designations are less awkward and more fluent than either the 'erist' or 'ist' constructions.

They also follow a pattern in common usage in other context including your profession. I would suggest the following:

a) One who inputs or operates a computer: COMPUTOR
b) The machine itself COMPUTER
c) The result: COMPUTED

The obvious parallel in publishing is:

a) Your job: EDITOR
b) The process of revision of copy: EDITING
c) A scheme of correction: EDITER
d) The end result: EDITED

This subject is trivial except that in the process of keeping a language 'alive', many usages that are incorrect or harsh sounding or cloudy or stilted creep in and are used by those who feel that a 'different' word for a commonplace one will somehow make their approach unique. Or these usages are just picked up by those who do not care or do not know and then become a part of the language.

I have no objection to 'ists', 'erists', 'isms' when they are logical and do not degrade the flow and sound of American English. But, I do think that when words are used as fairly precise descriptors that should mean the same things to all people that we should be careful which usage we use and the way that it is used.

Pete Charlton
Willow Park, TX

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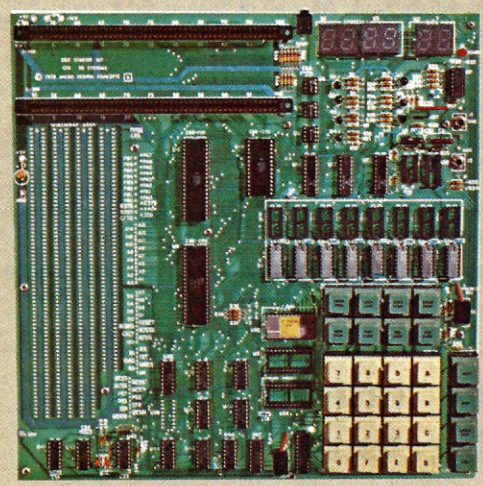

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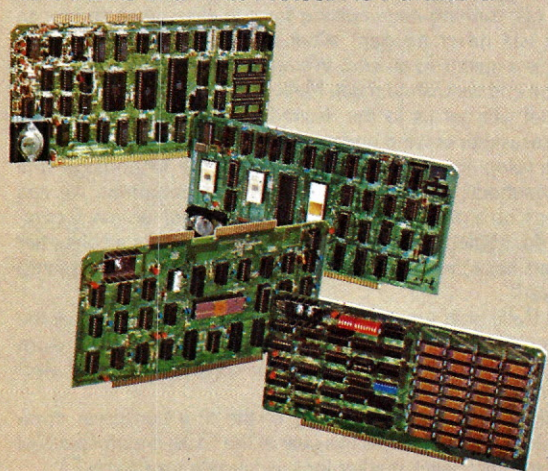

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SD Systems, Post Office Box 28810, Dallas, Texas 75228.

INDUSTRY MEMO

The key to selling computers these days is developing a consumer market. This can be done by setting a foot in the household with computer games and developing a public awareness of what computers can do. This was the general consensus of industry heads at the Consumer Electronics Show held in January of this year.

Sy Lipper, president of APF Electronics, a New York based electronics firm and makers of the MPA series of programmable computers, sees the home consumer computer as a viable product. According to Lipper, "Computers will be a part of daily life and will be one of the biggest volume and dollar products that the consumer electronics industry has put on the market, and will manifest itself over the next few years."

He also feels that the home computer will be the center of entertainment and home control. When asked how to get the consumer to accept the computer, he responded, "APF takes the approach by entering the home from the angle of entertainment — so they can see what a computer can do. Within a short time the consumer will want to handle the household budget on the computer, then even do business related projects. It's really unlimited."

Although APF has done extensive marketing surveys, Lipper says that it really boils down to a gut reaction, based on eleven years of serving the consumer electronics industry, to know what the public will really want and buy.

Lipper felt that although the PECOS computer introduced last year by APF got off to a slow start, the market potential is there and they feel it is a viable computer product.

On the other side of the coin, a representative of a large national retail firm was queried as to what they were looking for in a consumer computer. "We are looking for a product that we can deliver to the home owner that is totally turnkey — complete hardware and software all for one price. Right now, as far as we can see, that isn't available yet. However, we do expect to see that product available in just a few months. At that time we will offer it in several test markets and really evaluate its impact. We are in no big hurry to jump in. There is plenty of time to take the plunge," he said.

To reinforce these views of the market, INTERFACE AGE interviewed Jeffrey A. Rochlis, president of Mattel Electronics. Rochlis told us that "before Mattel made a commitment to the computer game and personal computer field, we did a marketing survey to determine exactly what the market was and the best way to enter it. Mattel is a very market intensive company and it's important for us to know what is wanted rather than to develop a product and try to market it. What we did was to conduct marketing surveys on video games, calculators and personal computers. Then, through focus groups of 10 to 12 people in many geographic areas, we did a study of perceptions and satisfactions. After all of this we did it again, this time with more refined questions and even had prototypes to show them. Each time, we refined concepts and made necessary modifications both to the survey and the product."

Rochlis also said "Because we are so concerned with consumer satisfaction, every product, game cartridge and ad is market tested before release. In reference to the current product of the INTELLUVISION, we found that the consumer had no frame of reference for the product, which means consumer education, something we feel we are very good at."

. . .the consumer computer is a long term involvement that will return. . .long-term benefits. . .to the consumer and the electronics industry.

Some of the other points brought out by Rochlis were: That Mattel projects the consumer computer market will require a three to five year educational period and sometime within that period it will have grown into a billion dollar plus market. He also felt that it will take a number of years to get a personal computer in every home, but possibly in five years 10% of the homes will own one.

Mattel plans to expand the product line through several generations, each time taking advantage of current technology and consumer awareness. Rochlis feels that the consumer cannot always handle the new technologies due to the lack of understanding. "However," he said, "technology can't and won't be denied and it will move very rapidly up until 1988. As a result we must gauge our product generation to keep pace with both technology and consumer awareness." The key, he felt, was being acutely aware of the difference between technological obsolescence and consumer obsolescence — what the consumer is willing to accept. By keeping that in mind Rochlis feels that Mattel can maintain a high-volume viable product on the market on a continuous basis.

Rochlis summed up Mattel's philosophy and possibly the industry's in general by stating, "Entering a new field, particularly a high technology field, is like a man standing beside a riverbank watching a fast running river, waiting for it to slow down so he can jump in. It will never happen! What we at Mattel realize is that technology is a means to an end. We are a profit-oriented company and that's the end we wish to meet. Mattel Electronics has three major attributes that will get us to the desired end. We have developed technological astuteness and understand the capabilities of our products; we develop innovative applications of the technology and marketing methods; finally, and probably most imporant, we can pull it through on a mass basis — something that not too many companies can do. Mattel is not in a computer business, but a consumer business and because we realize that we can realize the greatest market share."

Atari and Bally both parroted Lipper and Rochlis and feel that the consumer computer is a long term involvement that will return worthwhile, long-term benefits both to the consumer and the electronics industry.

Apparently 1979 is the beginning of the true consumer computer. Considering the entrants this year at the CES, the prospects of a fast moving high dollar market look extremely promising.□

Eliot Janeway Coming in April

Next month Eliot Janeway will join the prognisticators in INTERFACE AGE with a monthly column entitled "Ask Mr. Janeway."

Each month he will be answering questions sent in by our readers concerning the microcomputer industry and other aspects of our highly volatile economy. Questions about any type of business or the effects of inflation, recession or depression on the businessman or consumer are solicited. Personal responses are not possible.

Questions should be sent to: Ask Mr. Janeway, P.O. Box 1234, Cerritos, CA 90701.

"The argument about whether we'll have a recession and when we'll have a recession if we have one is off the point. It's a distraction. The governing question is how long interest rates will remain in double digit territory and how long the small operator will be required to pay a rate premium, a rate penalty over the prime rate, of anything from 4 to 6 percent. I'm afraid the outlook for the rest of '79 and most of '80 is that we're going to have very high interest rates. And that means that no business contraction is going to be mild," Janeway says as he begins the new column.

Being called controversial doesn't bother Eliot Janeway; in fact, he thrives on challenging established ideas that don't work in the real world. Distinguished and respected as a political economist, he prefers being called a "policy engineer." The range of his activities extends to books, newsletters, newspaper columns, Congressional testimony, radio and television appearances, magazine articles, counseling, seminars and lectures.

Based in New York City, Eliot Janeway operates with a professional staff of 14 running thriving, multi-faceted business which consists of:

- *The Janeway Letter* and *The Janeway Advisory Service,* weekly newsletters with a prestigious international audience.
- Four newspaper columns weekly, two of which appear daily, for syndication in the Chicago Tribune, New York Daily News, Washington Star, San Francisco Examiner, Atlanta Constitution and St. Louis Globe Democrat, among others.
- Five published books, the latest being *Musings on Money,* and a sixth in the making aimed at harnessing dollar power.
- A TV spot for New York's news round-up on Metromedia, giving practical tips for investing in the stock market.
- Quarterly business and investment conferences in Washington known as *The Janeway Seminars,* which anticipate political events and their economic and financial implications.

Eliot Janeway's career began in 1935 with the publication of the nationally recognized articles prescribing Depression remedies. In 1938, at the age of 25, Eliot Janeway was appointed Business Editor of *Time.* His war-time column in *Fortune* soon established him as the country's leading authority on economic warfare. As he rose to national prominence, Eliot Janeway advised at least seven presidents on the role of the economy in our political and financial lives.

In the midst of all this activity, he managed to find time to enjoy a private life with Elizabeth Janeway, his wife of 40 years and an author, lecturer and social historian in her own right. Together they raised two sons who, in turn, raised two grandchildren.□

R.H.D.
real handy data

By Robert H. Distler

WHAT IS A DATABASE?

A database is not too far removed from a filing cabinet. You may have heard this, but do you really have an understanding of what's in the filing cabinet?

In a typical business transaction such as a purchase, the first document issued is a purchase order. The next form received will be a shipper's copy, which is attached to the merchandise bought. When the merchandise arrives, the shipper's copy will be accompanied with a bill of lading from the freight company which brought the package.

The next item to be received will be an invoice from the vendor, reflecting the total charge for the item. This is placed in the filing cabinet along with the other papers associated with this transaction. At the end of the billing period, you may also receive a statement that references this invoice.

All these documents are kept together in the file cabinet — or database. The final item to join these forms in either the filing cabinet or the database is the check used to pay for the item. In the manual system, it is customary to go through the filing cabinet and mark all the documents associated with the sale with the number of the check.

This growing file in the cabinet will be used to furnish information to management on a number of different occasions. In addition, the file will be used to build records for the accounting system.

The file being referred to is on paper in a filing cabinet, but it is still a database. It is known as a variable database because it changes and grows as time passes.

Another form of database would be a simple file of business cards. As new ones are acquired, they are added to the file. This database is looked at, or accessed, when a phone number is needed. The cards can be referenced either by a person's name or the company name, or both. Therefore, we have two modes of access and three outputs. The outputs will be the phone number and the company name if we inquire by name, or name and phone number if the company listing is brought up.

A fixed database would be similar to listings in a dictionary. There are many different ways of looking at the database, but it does not change in size or content. Because it does not get bigger or smaller, it is really a reference database.

So what, then, is a database? It is a collection of information that can be used for day to day business transactions. There is one important difference between a database in a filing cabinet and a database in a computer. In the computer, the businessman has no idea what the physical form of those records is, nor does he have any clue as to where they are located. A programmer must know what form the records are kept in, where they are located and he must know how to reference the different pieces of information as they are needed. In a non-computerized business this reference is done by hand, with notations made on each document listing names, dates and amounts.

But with a computerized system, information for each document is entered only once. Those records that are associated with an invoice contain a reference to that invoice. Unlike the manual system, the computer database can tolerate repeated searches.

Some of the reasons for entering each item only once is to save storage space and eliminate errors. This consequently mandates that the database be easily edited (corrected). It must also be constructed with all the necessary information, with all the references being adequate duplications of the functions of a manual database.

While a businessman needs to insure that all the information is complete and no part is left out, the programmer must look at the needs of the business; what information must be readily available, what order it must be in and what the normal method of retrieval is. All of this must be communicated so the difficulties of switching from a manual system to a computerized database are kept to a minimum.

One of the most important things for a programmer to do when he is designing a database is to include some unused space for alteration or expansion of the records. These changes come about as businesses acquire a sense of the computer's filing and retrieving capability. Information that was not possible in a manual system becomes desirable when a computer system is installed. This is related to the cost of entering the data as compared to the savings or increase in productivity because this information is available at critical times for decision making.

A BUSINESSMAN'S DEFINTION OF DATABASE

Unfortunately, each business has its own individual way of maintaining its records. Therefore it is imperative that businessmen understand the needs of a programmer or a computer company and understand why the information is needed. The main reason is to realize the goals of having all the information available and to maintain the flexibility of a database.

The only way this can be accomplished is with cooperation between the business management and the programmer. This immediately requires some work by management to sit down and review each and every normal entry and each type of record the company uses. Perhaps the best way to accomplish this is for management to make a copy of each record as it is entered into the filing system.

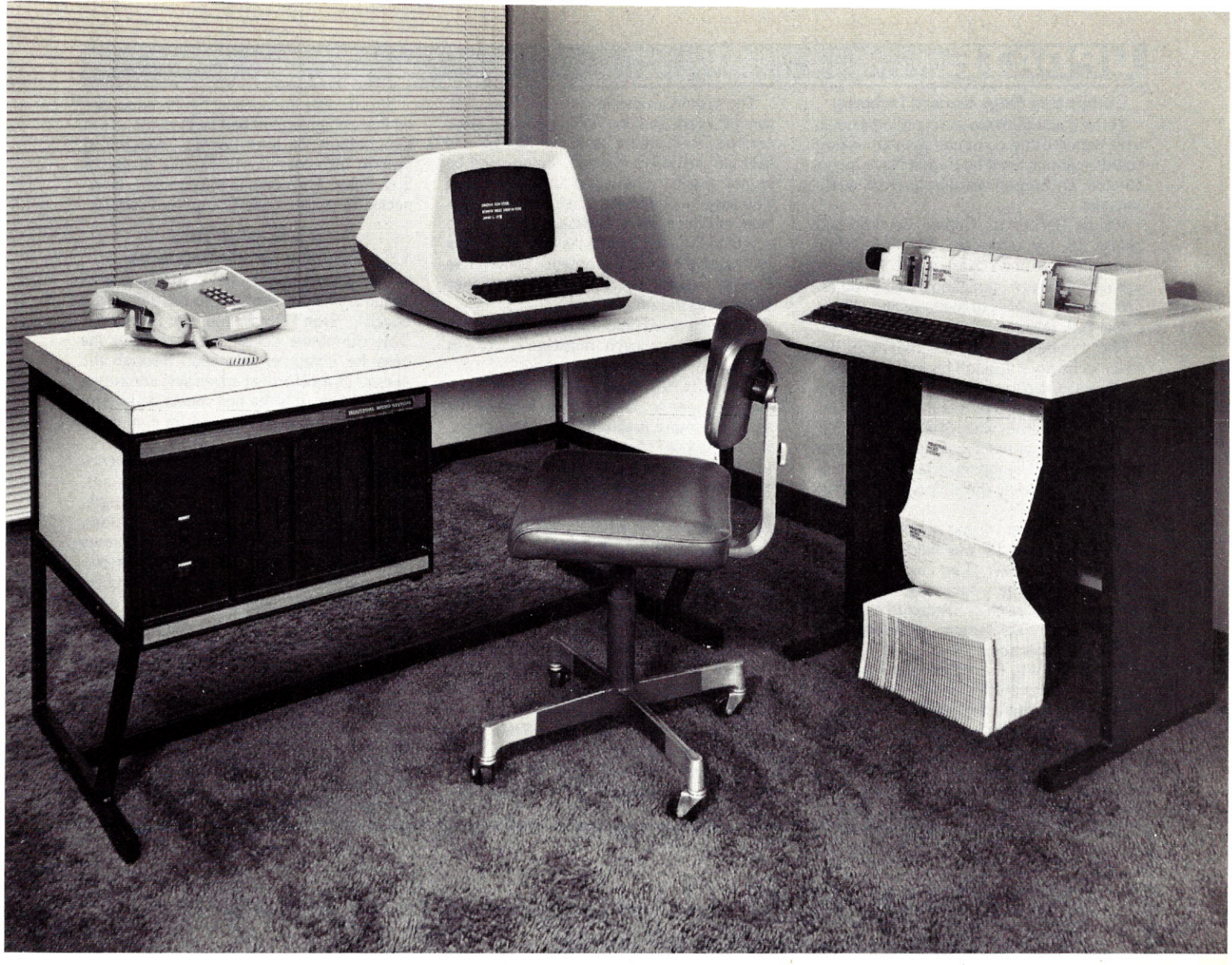
It is possible to be filing information that has no meaning or to be forgetting to file critical data or filing it incorrectly. Obviously these errors must be resolved before a complete database can exist.

It is the programming staff's responsibility to insure that all the needed information and cross references are put in the system. Business management has no idea what's going on inside the computer. Nor do the businessmen have any desire to find out. Therefore, they rely heavily on the programmers to construct a database.

This leads to a definition of a database as a collection of usable information for management to use in conducting normal business.

A database may or may not be constructed inside a computer. It can exist without a computer, but a computer installation cannot exist without an accurate and complete database. A database is one of the most important parts of computer installation in a small business, next to the programming itself.□

The author may be contacted at P.O. Box 6376, Oxnard, CA 93031, phone (805) 487-7422.



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UPDATE

Computers Help Record Industry

Three major Hollywood recording studios have begun using computer assisted mixing boards manufactured by Rupert Neve Incorporated, an English manufacturer of studio consoles.

Village Recording, Capitol Records and Studio 55 are using the NECAM (NEve Computer Assisted Mixer), which incorporates a Computer Automation minicomputer. The system has 16K of memory and utilizes a dual disk drive.

The computer recalls the moves of the mixer as he goes through his job of combining the recorded tracks of music. This allows him to combine two or more of his takes into a final work from which the master record is cut. The mixer works with the completed music recorded by the musicians, often after they are completely through with their part of the work.

Under the other mixing systems, once a mix was completed it was held only in the memory of the mixer. If he made a mistake on the last note, he would have to go back and start from scratch or attempt to combine two different mixes by ear, according to a NECAM spokesman.

With NECAM, the mixer can have the computer retrace his moves up to the desired point, then he can take over and combine his previous works or attempt another mix.

Because the mixer's work is held constant with the NECAM, it is possible to print several master copies, all sounding alike.

The system, priced in excess of $50,000, can be expanded to include several fader controls, so it can be used with the 32- and 40-track recorders currently being used by several groups. The faders allow the mixer, who may be one of the musicians, the engineer, producer or a professional mixer, to combine the recorded tracks into a final mix and highlight some instruments, at the same time preventing one instrument from overshadowing the others.

Mixing has become important in the last decade because each musician's work is now taped on a separate recorder.

The NECAM system also provides a slight increase in sound quality because the recorded sound is re-recorded fewer times, according to a Neve representative. Groups which have used the system include Fleetwood Mac and Supertramp.

Jade Drops Out of Surplus Business

Holding a large auction to get rid of some of its remaining stock, Jade Computer Products made its final completed a switch from selling computers and surplus equipment to marketing only computer gear.

The auction, held December 23 last year, attracted about 300 hobbyists and surplus buyers. The equipment, which ranged from dictaphones to ICs, brought a total of $62,179. Four other companies also marketed surplus goods at the sale.

"It worked out fine on our part. We got a fair return," said Don Smith, president of Jade.

Shortly after the auction, Smith announced that an agreement had been made to sell the company to John Leeper, president of Empire Industries. Empire is the owner of S.D. Sales. The name of the company is expected to remain Jade Computer Products.

TV Special Tells Personal Computing Story

The gospel of personal computing goes to television this spring with the airing of a special, "Don't Bother Me, I'm Learning." This 60-minute documentary presents the case for computer education through the eyes of its most ardent advocates: computer-hooked kids. It is the first special to be produced in the U.S. on the uses of computers in elementary schools.

Film was shot at Berkeley's Lawrence Hall of Science, at three elementary schools, and at a futuristic home in Hillsborough, California. In the course of the program, educators Art Luehrmann and Dean Brown talk eloquently about the value of the personal computer in our society; teachers share what they've seen classroom computers do for their students; parents watch their children converse with the computer in a math exercise, then try it themselves; and kids talk with enthusiasm about this companion "who can play any kind of game."

Along with the interviews, the documentary offers a sampling of the flashiest things home computers can do, from sci-fi games to elaborate graphics. The program was put together by Dave Shepardson, an indepen-

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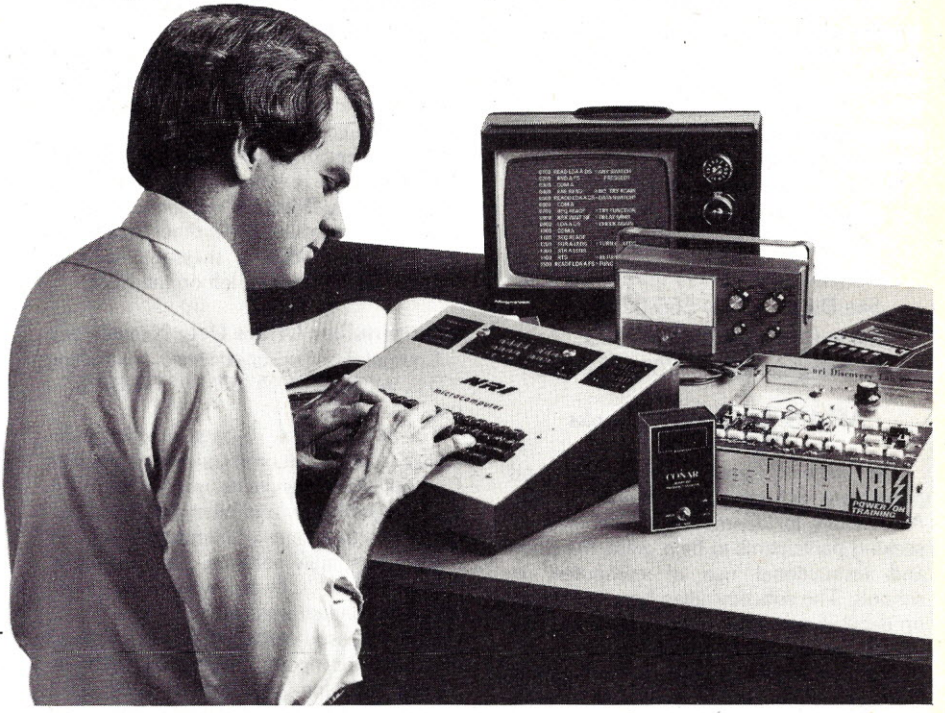

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dent television producer in San Francisco.

Watch your newspaper this spring for times and dates of the show.

Computerized Bulletin Boards

New computerized bulletin board systems (CBBS) have been starting up in a variety of cities. Rather than using the traditional corkboard, papers and thumbtacks, the CBBS uses a computer, disk files and a phone line.

The advantage of the CBBS is that anyone with the right equipment (a terminal and a modem) can phone the system and leave a message or read those left by others. When calling, the user must first type several returns to adjust the computer to the speed of the user's terminal.

A few of those now available include:

Atlanta (404) 458-4886
Chicago (312) 528-7141
New England (617) 963-8310
San Diego (714) 565-0761
Santa Clara (408) 246-2805
Washington, D.C. (703) 281-2125

ACM Subcommittee Seeks Participants

The recently-formed Elementary and Secondary Schools Subcommittee of the Association for Computing Machinery is seeking participants to help guide the study and instructional use of computers in schools. The subcommittee hopes to develop detailed recommendations for computer related content for the precollege level.

The committee will meet at the National Computer Conference, June 4-7 in New York. Persons interested in participating should contact Dr. David Moursund, Department of Computer Science, University of Oregon, Eugene, OR 97403.

Software Magazine

The Software Exchange is a new publication devoted to the exchange of ready to use software for business and the home.

The Software Exchange is a bi-monthly magazine available at computer stores for $1 per issue, and by subscription for $5 per year (six issues). For air mail service to Canada or Mexico, add $4. Subscriptions to other countries are $19 (air mail service). Inquiries may be sent to The Software Exchange, Box 55056, Valencia, CA 91355.

New Computer Club

A new computer club, as yet unnamed, is forming in the metropolitan Phoenix area. For information contact Marc Tessler, 3520 W. Dunlap Avenue, #106, Phoenix, AZ 85021, (602) 249-6224.

Phones with Computers Now in Use

AMF Harley-Davidson Motor Company of Milwaukee has installed a ROLM® computerized business telephone system that features the first commercially available phones to incorporate a contact lens-size computer and LED display.

Each of the 12 new telephones, called an ETS™ 100, has its own microprocessor that controls different circuits so the LED can show various things like the time of day or the elapsed time of a call.

These units, in turn, are linked to the Computerized Business Telephone System (CBX), which contains a larger computer that handles all of the primary telecommunications tasks such as incoming and outgoing calls.

The system also features Route Optimization, which automatically selects the least costly route for a call without the user having to know about it.

An electronic display shows the extension number calling, a call forwarded from another extension, or a special display if a conference call is in process.

Another unusual capability of the ETS 100 is as a message reminder. If someone in one of the Harley-Davidson locations calls an ETS 100 extension at the other facility and that person is out, a message such as "CALL 2123" can be left on the LED.

Computalker Offers User Newsletter

Computalker Consultants is now publishing "THE WORD FROM COMPUTALKER," a user newsletter.

The WORD is a 16-page newsletter designed to open up communications between Computalker Consultants, users of the CT-1 speech synthesizer and other interested parties. It contains items of interest about CT-1 applications, new software, new hardware, software fixes, software written by users, technical manual updates and more.

The first issue of the WORD is free to all who write for a copy. Five issues will be included with the purchase of each CT-1 speech synthesizer. Additional copies of the WORD will cost 60¢ each. For a free copy or more information contact Computalker Consultants, 1730 21st St., Suite A, Santa Monica, CA 90404, (213) 392-5230.

MIA Has New Address

The Microcomputer Investors Association has moved to a new address: 902 Ansdel Court, Reston, VA 22091.

The nonprofit association seeks to assist persons using micros to examine and keep track of their financial investments. Dues are $30 per year, with each member required to write one article per year for the group's monthly journal. For information contact Jack Williams at the above address.

Semiconductor Industry Forming Safety Group

The Semiconductor Safety Association (SSA) has been formed to promote an exchange of safety related information within the electronic components industry. Companies represented include Fairchild Camera, Hewlett-Packard, Honeywell, Intel, Mostek, Motorola, and Texas Instruments.

Bill Turney, Corporate Safety Director of Texas Instruments was appointed chairman.

During the group's first meeting, members discussed and heard presentations on such subjects as fatal accident investigation, chemical management, proposed OSHA regulations, industrial hygiene procedures, and workmen's compensation.

The Simple Up-Grade™

Trying to add computer memory is not much fun if you don't get everything you need.

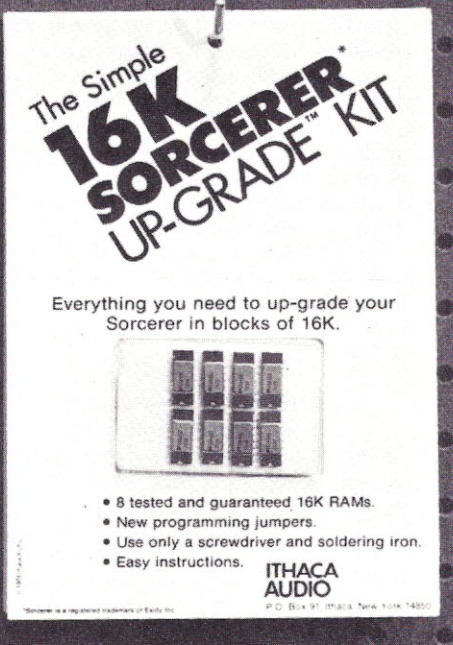
step directions and diagrams. And if a personality jumper is required, *it's premade.*

The TRS-80* memory expansion was our first Simple Up-Grade. Now there are two more—for owners of Apple II† and Exidy Sorcerer‡ computers. Each kit is 100% guaranteed—if a part ever fails, we replace it FREE. Your Ithaca Audio dealer has them in stock, only $140. Now you can afford to add high quality, high density memory to your system for remarkably little—far less than you would expect to pay from Radio Shack, Apple, or Exidy directly.

These Simple Up-Grades are Ithaca Audio's first step in adding more capability and reliability to your computer at lower cost. Other Up-Grades are on the way to your dealer now.

Receiving unprogrammed jumpers and having to program them yourself is not much better. Most important, that's the place where the problems are introduced.

So Ithaca Audio's better idea is the Simple Up-Grade. Each Simple Up-Grade is specially designed to make adding memory foolproof. We include all the parts you'll need; 8 prime, tested 16K RAMs, along with concise step by



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CALENDAR

Beginning with this issue, the format of Calendar will be changed. Rather than listing the meetings of computer clubs, a job better handled by each club's newsletter, Calendar will now be a listing of microcomputer seminars and shows, along with any related shows which would be of interest to our readers. The formation of new clubs will be listed in Update.

Federal DP Expo

The fifth annual presentation of the Federal DP Expo will be conducted March 19-21 at the Sheraton Park Hotel in Washington, D.C. The show, with over 150 exhibiting companies, will be one of the largest expositions of computer hardware, software and services ever held in the nation's capitol.

For information contact The Interface Group, 160 Speen St., Framingham, MA 01701, (800) 225-4620 and (617) 879-4502 in Massachusetts.

Personal Computer Fair

The Northwest Computer Club and the Pacific Science Center will co-sponsor the second annual Personal Computer Fair March 10 and 11 at the Science Center in Seattle, Washington.

The fair acquaints the public with personal, home and hobby computer applications. Visitors see a variety of non-technical demonstrations and have numerous opportunities for hands-on experimentation.

More than 5,000 people attended last year's event. For information contact Susan Stocker, (206) 624-8140.

Wharton School Seminar

The cash impact of manufacturing decisions is the focus of "Effective Production Planning and Inventory Management," a seminar presented by the Wharton School of the University of Pennsylvania in four cities: March 12-13 in Houston, April 16-17 in Toronto, May 14-15 in San Francisco, and June 25-26 in Chicago.

Designed for manufacturing organization executives, the seminar presents techniques to increase working capital, reduce inventories without compromising service, forecast market demands, resolve potential problems and minimize shortages and production delays. The seminar leader is Dr. Morris A. Cohen, Professor of Decision Sciences at The Wharton School.

For a detailed brochure and registration information, contact Heidi E. Kaplan, Dept. 20 NR, New York Management Center, 360 Lexington Ave., New York, NY 10017, (212) 953-7262.

Microcomputer Hardware and System Design Seminar

Polytechnic Institute of New York and the Institute for Advanced Professional Studies are presenting a three-day intensive seminar for engineers, programmers, and technical managers with a working knowledge of digital hardware design and familiarity with the underlying concepts governing microprocessor operation, architecture, and systems design.

The seminar, directed by Dr. Glendon P. Marston, Vice President, Institute for Advanced Professional Studies, is titled, "Microcomputer Hardware and System Design." Seminar leaders, including guest lecturers from microprocessor manufacturers, will conduct case studies, lectures as well as laboratory sessions and will be available for informal discussion.

The seminar will be held March 21-23 at the Holiday Inn in Palo Alto. For more information call Professor Donald D. French at (617) 964-1412 or write to the Institute for Advanced Professional Studies, One Gateway Ctr., Newton, MA 02158.

PARC Sponsors Swapfest

The Ninth Annual North Florida Swapfest, sponsored by the Playground Amateur Radio Club (PARC) will be held in Ft. Walton Beach on March 24 and 25 at the Okaloosa County Shrine Fairgrounds. The display area will be open from 8 AM to 4 PM each day.

The Annual North Florida Swapfest is sanctioned by the American Radio Relay League (ARRL) and attracts hundreds of radio amateurs, electronics hobbyists and computer enthusiasts from all over the Southeastern United States.

The North Florida Swapfest is essentially a non-profit function and proceeds are used to finance the next Annual Swapfest, local amateur radio projects, and the Playground Amateur Radio Club Scholarship Fund. Last year prizes valued at more than $2500 were awarded. For information contact Dwayne Sparks, 300 Argyle Ct., Mary Esther, FL 32569.

IDC Executive Conference

Dr. Lawrence Peters, author of the book *The Peter Principle,* will be the wrap-up speaker at International Data Corporation's Spring 1979 Executive Conference on Automated Business Communications. Slated for April 1-4, the conference will be held at the Camelback Inn in Scottsdale, Arizona.

The conference is priced at $750, with additional team members from the same organization able to attend at the reduced price of $495 each. Members of IDC's Continuous Information Services attend these conferences free.

For information contact George Pardi at IDC's Corporate Headquarters at 214 Third Ave., Waltham, MA 02254, (800) 225-8952.

Two Data Entry Courses

Management Information Corporation is sponsoring two interactive seminars that deal with data entry. Discussions with instructors and other participants will provide solutions to problems that can be easily implemented. Many data entry managers, supervisors, lead operators, DP managers, and data entry technical support personnel will benefit from these seminars.

The "Data Entry Management and Supervision" seminar includes instruction in data entry system concepts, organization of the

data entry department, data entry control techniques and operator training.

MIC is holding the course at the Cherry Hill Inn in Cherry Hill, New Jersey on April 2-4 and June 18-20. For information contact Management Information Corp., 140 Barclay Ctr., Cherry Hill, NJ 08034.

PASCAL Programming Workshop

Polytechnic Institute of New York and the Institute for Advanced Professional Studies are presenting a five-day intensive seminar for engineers, programmers and technical managers. The seminar, directed by George Poonen of DEC, is titled, "PASCAL Programming for Mini and Microcomputers." Application examples, lectures, informal sessions with the instructor, as well as individual and group programming sessions, are part of the course.

The seminar will be held April 23-27 at The Ramada Inn, Woburn, Massachusetts. For information contact Professor Donald D. French at (617) 964-1412 or the Institute for Advanced Professional Studies, One Gateway Ctr., Newton, MA 02158.

Upcoming Shows

Electronics Conventions has announced the dates of three shows. The Electro/79 Show and Convention will be held April 24-26 in the New York Coliseum and the American Hotel in New York City. Charles Brown, chairman of the board of American Telephone and Telegraph, will be the keynote speaker.

Wescon/79 will be held in San Francisco at Brooks Hall and the St. Francis Hotel on September 18-20.

Chicago will be the site of Midcon/79 November 6-8. For information phone (800) 421-6816. In California call (213) 772-2965.

Introductory Short Course

A two-week short course entitled "Introduction to Digital Electronics and Microcomputer Interfacing" will be held July 16-27 in the Shenandoah Valley in Virginia. The course will include hands-on laboratory work for academic and industrial personnel, with one micro lab for each two participants. Approximately 60 hours of laboratory instruction will be given. Academic credit for the course is available.

Tuition is $395. Living accommodations including free camping facilities are available. For information contact Prof. Philip Peters, Dept. of Physics, Virginia Military Institute, Lexington, VA 24450.

NCS Dates Change

The Northeast Computer Show, originally scheduled on April 6-8 has been moved to the weekend of September 28-30. The producers, Northeast Expositions, found that far more exhibit space was needed for the show than was originally estimated, hence the change to the Hynes Auditorium in Boston.

There will be two separate sections to the show. The personal computing section will feature microcomputers, small computer systems, business opportunities, electronic and video games, career and employment opportunities, educational exhibits, free seminars and lectures. Dozens of free lectures and seminars will be given by internationally recognized speakers, along with introductory classes, for all categories and levels of enthusiasts.

Small business systems, including word processing, data processing and other peripherals will occupy the other sections of the show. For neophytes, communicators will give concise comprehensive familiarization seminars, using laymen's language rather than technical terminology. The seminars will be held in soundproof rooms equipped with audio-visual aids.

The admission price is $5 for adults and $4 for college and high school students. For information contact Northeast Expositions, Box 678, Brookline Village, MA 02147, (617) 522-4467.

Minicomputers and Distributed Processing

The uses, economics, programming and implementation of minicomputers are the focus of "Minicomputers and Distributed Processing," a three-day seminar presented by the University of Chicago Center for

Continuing Education in several cities: May 16-18 in San Francisco, June 13-15 in Chicago, July 23-25 in Toronto, August 15-17 in Atlanta and September 24-26 in New York.

Specific topics for the seminar include minicomputer architecture, peripheral processing, communications support for distributed networks, application oriented systems, intelligent terminals used in distributed systems, mini-based business systems, and word processing.

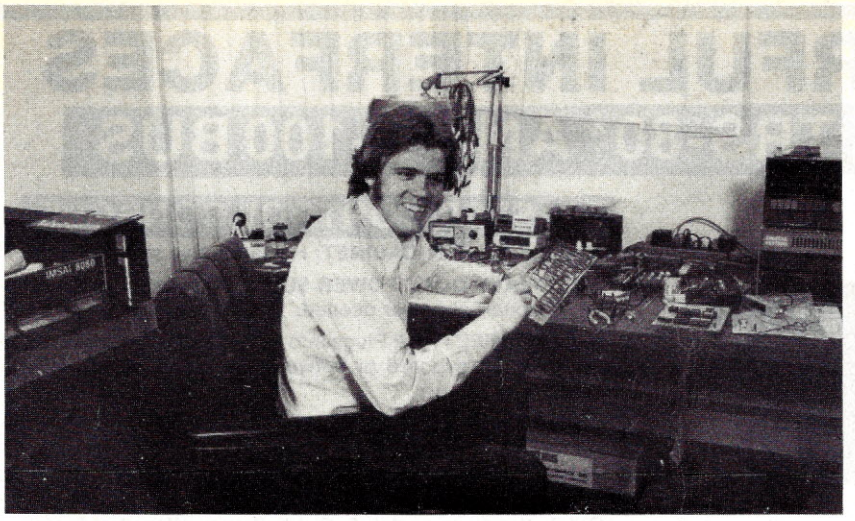
The seminar leader is George R. Trimble, Jr., president of T-Logic, Inc., a consulting firm. For information contact Heidi Kaplan, Dept. 20 NR, University of Chicago Continuing Education Programs, 360 Lexington Ave., New York, NY 10017, (800) 223-7450.

Personal Computing Festival for NCC

Richard A. Kuzmack, senior economist with the Mathtech Division of Mathematica, Inc., has been named chairman of the Personal Computing Festival for the 1979 National Computer Conference which will take place June 4-7 in New York City.

The Personal Computing Festival, to be held at the Americana Hotel, will feature technical program sessions plus application demonstrations and commercial exhibits.

For more information contact AFIPS, 210 Summit Ave., Montvale, NJ 07645, (201) 391-9810.



HELLO FELLOW COMPUTERIST...

At this time I wish to introduce myself. I am PERRY POLLOCK, the owner, manufacturer and designer of the products advertised in this issue of this fine magazine. In the issues to come, I will be introducing more powerful interfaces for the various popular computers.

To take advantage of this opportunity, I would like to tell you a little about my beliefs, aims and policies. Starting out as a hobbiest, I realize your needs, concerns and most of all the requirements of a good, well designed and fairly priced interfaces for your computer. It is my goal to supply you with the most for your investment and the highest quality possible.

All the products are designed by me. They are first drawn out and logically analyzed. Then they are wire wrapped and tested. When I am satisfied that it functions well, then I will etch a sample printed circuit board, then and only then, will I commit the design to a mass production run.

All the parts used in our products are of the highest quality. The manuals are written so you can understand all the phases of construction and operation. How many times have we bought a product and it lacked for a good, understandable manual, or has it had so many flaws that we could swear that we were re-designing the product. ALL OF THIS IS IN THE PAST. These products are not offered unless they are right!!!

Another one of my aims is to let you know who you are dealing with. How many times have we ordered a product and wondered who we were really dealing with. Then... if we had problems, how difficult was it to contact them? Because of all this, I have chosen to publish a picture of myself (I'm not vain, really) and a picture of my wife Korrine (pictured below). I am available 24 HOURS A DAY. I have a telephone answering service that will put your call through to me anytime day or night, or if you wish you can call me at home. (602) 886-5037. If you have a problem, question or just want to talk, give me a call.

I have many exciting new products under development. It will be an exciting year and I hope you will enjoy the interfaces designed for you and I. I know these interfaces have made my computer more enjoyable for me and hopefully for you.

Sincerely,

Perry and Korrine Pollock
Your fellow computerists
WORLD POWER SYSTEMS, INC.

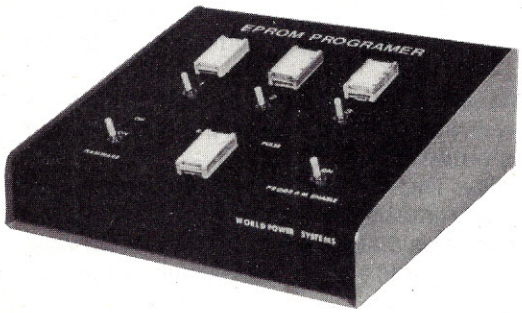
P.S.: My guarantee . . . If you are not satisfied with the product, return it to your dealer or me for a full refund within 5 days of purchase.

3 POWERFUL INTERFACES
FOR THE TRS-80* AND S-100 BUS

Model MCC-K (kit) $129.95
Model MCC-A (assem.) $159.95

MASTER CONTROL CONSOLE

- **COMPLETE WITH CABINET:** Has attractive sloping cabinet.
- **FULL HEAVY DUTY POWER SUPPLY:** Contains power supply. No external power needed.
- **EASY CONNECTION:** Plugs into TRS-80 expansion port edge card rear of keyboard or between keyboard and expansion interface.
- **2-EDGE CONNECTORS:** 2-additional expansion 40 pin edge connectors.
- **NEEDS NO SOFTWARE:** Operates from OUT and IN statements from BASIC or machine code statements. Example: (Out 5, 1=turn on switch 5. Out 5, 2=turn off switch 5, etc.)
- **COMPLETE MANUAL AND SAMPLE PROGRAMS:** Comes with comprehensive manual.



Model EPR-80K (kit) $129.95
Model EPR-80A (assem.) $159.95

EPROM PROGRAMMER +3

- **3 ADDRESSABLE ROM LOCATIONS:** The Eprom Programmer has three sockets on front panel which are addressable to any location by dip switch. In addition each ROM location can be shut off or turned on by switches located on the front panel.
- **MONITOR:** A monitor is supplied within the firmware for performing several functions. Verify, program from memory, program from TTY input, etc.
- **EASY CONNECTION:** The Eprom Programmer is attached with ease. The unit plugs into the rear of the keyboard or between the keyboard and expansion interface. Included with the unit are two additional 40 pin edge connections for interfacing of other interfaces.
- **FULLY BUFFERED:** Data lines are fully buffered.
- **OTHER FEATURES:** Other features include status lights for which ROM selected, switch enable for programming, pulse (burn) indicator firmware select-deselect switch, on and off and dip switches for the addressing of each ROM location.

- **8-SERIAL INPUT/OUTPUT PORTS:**
- **8-PARALLEL INPUT/OUTPUT PORTS:**

Model MS10-K $129.95
Model MS10-A (assem.) $149.95

SERIAL PARALLEL I/O MODULE

- **EASY CONNECTION:** Connects to the expansion port edge card connector between keyboard and expansion interface or direct to rear of the TRS-80 keyboard.
- **DIP SWITCH:** All ports, baud rate, parity, etc all set by dip switches.
- **ON BOARD FIRMWARE:** No software driver routine needed for operation of the module. Simple OUT and IN statements operate the module.
- **RS-232, CURRENT LOOP:** All 8 channels can be selected for RS-232 or current loop.
- **BAUD RATE SELECTION:** All channels dip switch selectable for individual baud rates from 110 to 9600 baud.

TERMS

CASH WITH ORDER, VISA, MASTER CHARGE. NO C.O.D.'S! PERSONAL CHECKS REQUIRE 3-WEEKS TO CLEAR.

ORDER FROM

WORLD POWER SYSTEMS, INC.

1161 N. El Dorado Place, Tucson, Arizona 85715
24 Hour Order Phone No: 602-886-2537
(Dealers: Write or phone for information)

STOCKING DISTRIBUTOR FOR SOUTHERN CALIFORNIA CONTACT: CALIFORNIA DIGITAL 213-679-9001

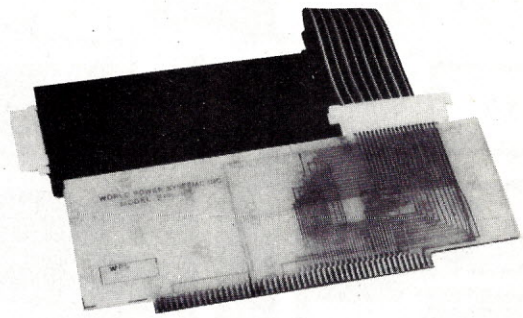
*Trademark: Radio Shack

3 POWERFUL INTERFACES

FOR THE TRS-80* AND S-100 BUS

TRS-80 TO S-100 BUS CABLE ADAPTER

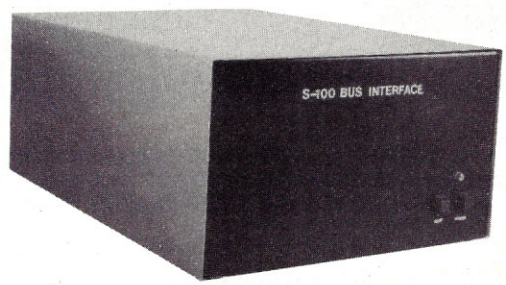
- **FULL INTERFACE:** Contained within the cable assembly, is a small enclosure. This enclosure contains all the logic to convert your TRS-80 to be compatible with the S-100 bus system.
- **FULL BUFFERING:** All address, data and signal lines are fully buffered.
- **EASY CONNECTION:** It is easy to connect. Just plug the one end of the cable into one slot on your S-100 system and plug the other end into the rear of the TRS-80 keyboard or between the expansion interface. Turn on and go . . .
- **TWO EDGE CONNECTORS:** Two addition 40 pin port edge connectors are provided for other connection of expansion interfaces.
- **POWER:** All power is derived from the S-100 bus structure. Since the TRS-80 will not support other devices hooked to its power supply, it is a must that your S-100 supply =8-10 volts D.C. Logic card contained within the cable has on board 5 volt regulator. Current requirements is 375 ma. Unit has separate terminal for exterior connection of DC power requirement if it is to be supplied outside the S-100 bus system.
- **FULL OPERATION MANUAL:** Not much need for a manual, but we have prepared one with full principal of operation, etc.



Model CAB-80K (kit) $99.95
Model CAB-80A (assem.) $119.95

TRS-80 TO S-100 BUS

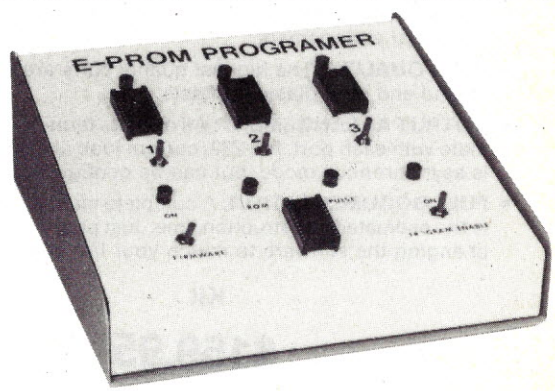
- **FULLY SELF CONTAINED POWER SUPPLY.** (10 AMP)
- **BUS TERMINATION:** Bus termination and conditioning for no croos talk or noise etc.
- **S-100 SIGNALS:** All required S-100 signals are generated by on board logic and is fully compatible with the TRS-80.
- **COMPLETE:** Comes complete with cabinet, card guides, on off switch and sockets. Nothing else to buy.
- **STAND ALONE:** This system can stand alone or can operate with the TRS-80. All input, output, address and signal lines fully buffered between TRS-80 and S-100 BUS system.
- **EASY CONNECTION:** Just plug it into the rear of the keyboard or between the keyboard and expansion interface. Also includes two 40 pin edge connectors for connection to other interfaces.



Model RSB-K (kit) $249.95
Model RSB-A (assem.) $289.95

S-100 EPROM PROGRAMMER +3

*All the same features of the TRS-80 model. Comes complete with interface cable, S-100 plug-in card. Totally self-contained power supply, plus many other extras.



Model EPR-100K (kit) $129.95
Model EPR-100A (assem.) $159.95

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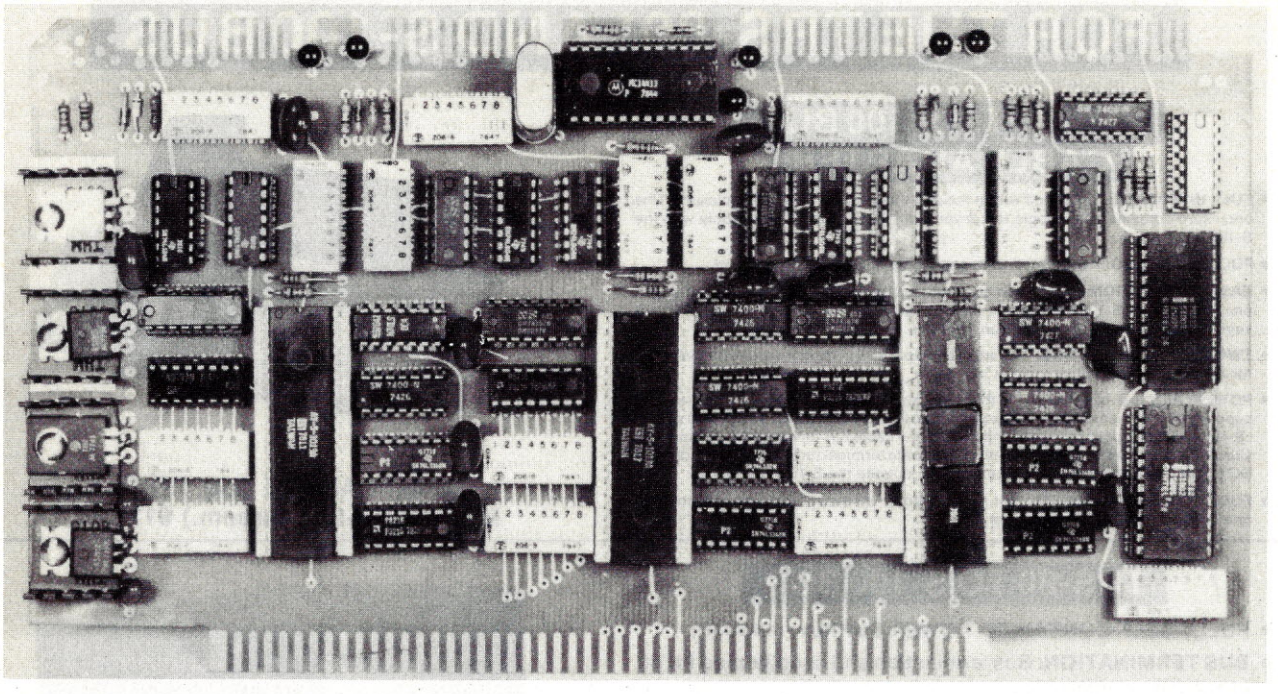
3 S+P INTERFACE CARD



A POWERFUL I/O INTERFACE CARD FOR ANY S-100 BUS. THREE SERIAL PORTS AND ONE PARALLEL PORT. FULLY HARDWARE OPERATED. NO SOFTWARE INITIALIZATON REQUIRED. IN ADDITION, THIS BOARD WILL OPERATE WITH ANY SOFTWARE. USER IS ABLE TO SELECT STATUS BITS TO FIT ANY SOFTWARE CONFIGURATION.

FEATURES

- **SELECTABLE BAUD RATES:** All baud rates are dip switch selectable. Each port can be set for its own baud rate. CRYSTAL CONTROLLED baud rates. This interface card can operate with any Micro-processor at any speed. The 3 S+P does not depend on the CPU for its originating clock. 110-9600 baud.
- **EASY CONFIGURATION:** The 3 S+P is easy to set. All port addresses are set by dip switches. Each port can be assigned, independent of each other.
- **SOFTWARE COMPATIBLE:** The 3 S+P will be compatible with most software arrangements due to the ability to set the status bits and the parity. Parity, character length, stop bits all set by dip switches. Each port can be set to it's own individual arrangement.
- **HIGH QUALITY:** The highest quality parts are used. P.C. Board is with plated through holes, solder mask, silk screen legend and gold plated contacts.
- **OUTPUT ARRANGEMENT:** All outputs terminate at the top of the card via a 26 contacts. Standard 26 pin IDC connectors mate with each port. RS-232, current loop at each serial port and full data lines at the parallel port connection. Operation is asynchronous mode, but can be configured for synchronous operation by minor re-configuration.
- **FULL DOCUMENTATION:** A complete manual of operation and construction is included. Easy construction and 3 hours is the estimated construction time. Just plug in, set the switches and enjoy all the different configured software. NO MORE changing the software to match your I/O board. Just set the board and enjoy.

Kit **$159.95**

Assembled **$189.95**

OPTIONS

Connecting cables from 26 pin to standard DB-25 are separate. Molded factory cables are available for $14.95 each. Cables have 26 pin IDC connector at one end and DB-25 female at other end, connected by ribbon cable.

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INTERFACE AGE™

MAGAZINE

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FROM THE FOUNTAINHEAD

By Adam Osborne

In the November 1978 "From the Fountainhead," Dr. Osborne warned readers not to buy directly from manufacturers. This warning did not necessarily reflect the views of the majority of the industry or this magazine. As a result of Dr. Osborne's warning, we have received a number of calls and letters from manufacturers in rebuttal.

Since it is not the purpose of INTERFACE AGE to engage in adversary journalism, we have elected to remove any further mention of this warning from this column.

However, due to the amount of importance Dr. Osborne and manufacturers place on this matter, all letters of rebuttal will be forwarded to Dr. Osborne. The letter and his comments will then be published in the "Letters to the Editor" column, if in **my** *opinion they do not engage in meaningless diatribe, and serve the purpose of enlightening the consumer.*

carl

I have received a number of letters from **European customers complaining of problems** dealing with American microcomputer manufacturers. Why are there so many problems? The answer, I believe, is a chronic one that plagues so much of the U.S. industry: they simply do not pay attention to foreign markets because the U.S. market is so much larger.

A Japanese or European manufacturer looks at the U.S.A. as a major outlet. Therefore, they tailor their products to the U.S. customer, who usually cannot tell whether a product was manufactured domestically or abroad.

In sharp contrast, too many manufacturers in the U.S.A. take a cavalier attitude towards foreign markets. They advertise in foreign journals, and frequently do nothing more. For example, I have received more than one complaint that equipment was received in Europe with 110 volt 60Hz power supplies.

I can understand the initial frustration which a U.S. manufacturer must experience when trying to deal with a dozen different foreign countries, each of whom do not look like much of a business prospect as compared to the domestic market. But unfortunately, too many companies in the U.S.A. have adopted a "take-it-or-leave-it" attitude toward foreign markets. I do not single out the microcomputer industry in this respect. Detroit, for example, designs cars for the domestic market, deigning to fill any foreign orders that flutter unexpectedly through an open window. Perhaps that is why the U.S. dollar is in so much trouble.

So far as the microcomputer industry is concerned, U.S. manufacturers are missing a great opportunity by ignoring the foreign market. Without visiting Europe, it is hard to appreciate how far ahead the U.S. microelectronic industry really is. This state of affairs will not last forever. European manufacturers are already beginning to fill the void and if U.S. exports are ultimately shut out, U.S. manufacturers will have no one to blame but themselves. U.S. manufacturers must take the time to understand their foreign markets. They must design products that will work in a foreign country. They must write documentation in the language of the foreign country. They must learn how to deal with shipping and customs. Only after completing these preliminary steps should they advertise in foreign journals. Any U.S. manufacturer who takes the time and effort to do this will be amazed at the size of the European market, and particularly at its rate of growth.

Robin Bardbeer, writing from the **Polytechnic of North London,** sent me a press release on the North London Hobby Computer Club. The November 1978 meeting of this club attracted more than 200 members and friends. Forty members decided to form a PET users group. At this point, the North London Hobby Computer Club would appear to be just as large and vigorous as any similar club in the U.S.A.

The **Commodore PET, Apple II, and Radio Shack TRS-80** microcomputers are becoming the most popular products in the personal and home entertainment markets. Robert Purser recently published an excellent catalog of low cost software for these three microcomputers. If you have a PET, TRS-80 or Apple, and do not have Purser's catalog, get one for only $2. His address is:

Robert Purser
P.O. Box 466
El Dorado, CA 95623

The Software Exchange is another good place to find software information of all kinds. The Software Exchange is a new magazine which is definitely filling a need. For more information, they can be contacted at Box 55056, Valencia, CA 91355.

In my October, 1978 column I asked for comments on **microcomputer hardware reliability.** I have not received a single complaint regarding microcomputer hardware, but I have received a number of letters from minicomputer owners reciting their tales of woe. Dr. Leo Biese, for example, has had problems with Digital Equipment Corporation (the giants of the minicomputer world) that far exceed any horror story I have ever heard from a microcomputer system owner. I maintain that the simplicity of most microcomputer logic design is its biggest asset, and the principal reason for its inherent reliability, as compared to minicomputers and mainframes. So, microcomputer buyers, take heart; had you bought a minicomputer, you would have paid more to buy it, spend less time using it and more time fixing it.

Mr. Tom Swanson wrote asking if anyone knew how to improve the sound quality of some 25-year-old **gramophone records.** I know people have worked on taking the clicks and fuzz out of old recordings, but this is a subject that I know nothing about. If you can help Tom, please write to him directly at 7505 Bern St., Anchorage, AK 99507.☐

"My Structured Systems business software has paid for itself in labor hours saved alone."

Mr. Ken Tunnah, Colloid-A-Tron Inc., Buffalo, New York

Ken Tunnah is one of many innovators bringing the micro revolution to the small business. As a programmer, he knows computers and their languages. As a businessman, he knows business and its languages. And when Mr. Tunnah decided to micro-computerize the accounting function at Colloid-A-Tron, he turned to Structured Systems software.

Says Mr. Tunnah: *"The program is designed from a CPA standpoint, for multiple corporations, which we have. It is flexible and gives me the ability to change reporting by profit centers easily. It is up and running quickly, and it just keeps on running. I think it's the best business software available."*

The best software available. That's what Structured Systems Group set out to create.

Structured Systems offers three sophisticated accounting systems. Our General Ledger software is big enough for multi-client write-up by the CPA, or multi-corporate reporting for the business, but small enough for the micro budget. The very comprehensive Accounts Receivable and Accounts Payable packages will operate independently, or they will coordinate with the General Ledger.

Our systems record transactions easily and correctly, and provide an audit trail from source document to financial statements. And they will maintain monthly and year-to-date information in dollars and in percentages. And they are reliable.

The three systems interact with the user to set up parameters such as format and headings, account titles and numbering, automatic billing or reminder notices, credit limits, sales reports, a check register, and much more.

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MICRO MEDICINE

By Wm. V. Weiss, M.D.
Professional Engineer

AUTOMATED MULTIPHASIC HEALTH TESTING (AMHT)

In last month's column I mentioned the phrase "multiphasic health testing." This process has had many advocates in the past fourteen years, but the "full flowering" of this example of computerized medical care has yet to fulfill the predicted promise. Can information processing be used in routine ambulatory (office and clinic) health care delivery to provide "better" or more comprehensive care at lower cost? Many people believe so, but for many reasons the idea has not caught on. Perhaps it has been a concept "before its time."

The concept of automated multiphasic health testing (AMHT) was a culmination of many activities. In the middle sixties, people were beginning to expect more of the health care system due to many advances in medical and computer science. Many systems analysts, turning their attention to the "lucrative health industrial complex," believed that the organization and delivery of health care could be optimized and a study of old fragmented medical activities got under way.

The systems planners believed the routine annual physical could be broken into components and automated much like an assembly line. By such streamlined techniques it was hoped that the logistics of health care could be made comprehensive and cost-effective. This seemed logical and progressive, but there was a nagging doubt in many minds (mostly medical) that the approach represented "engineering overkill" and that health care could not or should not be reduced to an "assembly line process."

At the same time, it must be recalled that people believed in the sanctity of the "annual physical exam," as many still do. This concept was considered the only true way to pick up problems early. Subsequent analysis of this belief has raised serious doubts as to its validity, but to a large extent this discovery might not have happened without the perspective of years of analyzing AMHTs performed on a large population.

So the engineers developed a system for performing a host of different tests on a patient in a brief encounter, and the term "multiphasic screening" was born. The guiding principle was that early detection of disease would result in early treatment. In any such program, the trick is to refine your "net" pore size such as to detect true positives, but avoid as many false positives as possible. Also, to be realistic and cost-effective, one only screens for those illnesses which are relatively common, not too expensive to detect, and for which some kind of treatment is possible. I must stress that screening implies the patient is well, asymptomatic and thus subclinical illness is the target.

Even today there is considerable controversy over the concept of "subclinical illness" and it was previously expected that AMHT might help shed some light on this question. The results are not yet in.

What started as an attempt at cost-effectiveness seems to have been partially lost in the scramble by industry to capitalize on a potentially explosive market opportunity. Talk about engineering gone crazy, one after the other more dazzling systems evolved to perform the various measurements and feed the data to the system computers. Nobody really sat back and questioned how valid the tests, why we were measuring such and such, and whether or not early diagnosis was rational. At one point, there were a large number of companies in the act of producing instant AMHT clinics, vans, etc., but few were purchased because most felt the concept needed further study.

Dr. Morris Collen, Director of the Oakland based Kaiser-Permanente Medical Plan, was the earliest proponent of such techniques. He stressed the value of longitudinal studies of AMHT to prove financial and medical efficacy. It is largely through his efforts that relative perspective has been achieved over 14 years. As directors of a very large insurance plan, they saw this (AMHT) as a cost-effective means of monitoring their subscriber population. There has been some success, although some of the medical optimism has been tempered. Typical of the battery of tests pioneered and copied by others were:

1. Automated Medical History
   Presented in a branching order via slide or film "consoles" which were patient controlled via computer link. Psychological tests were an option.
2. Anthropometry
   Height, weight, skinfold thickness, etc.
3. Cardiovascular System
   Blood pressure, electrocardiogram and phonocardiogram (heart sounds).
4. Pulmonary System
   Chest x-ray, pulmonary function tests (breathing dynamics).
5. Special Senses
   Hearing tests, visual acuity, tonometry (ocular tension), color vision, eye balance, etc.
6. Gynecologic System
   PAP test, mamogram.
7. Hematology
   White and red blood cell counts, hemoglobin, hematocrit, various indices.
8. Blood Chemistry (wide variation in numbers done — basics follow)
   Glucose, calcium, phosphorus, phosphatase, SGOT, LDH, bilirubin, uric acid, BUN, total protein, albumin, cholesterol, triglycerides, etc.
9. Serology (tests on serum of blood)
   VDRL (test for syphilis), rheumatoid factor, etc.
10. Urinalysis
    PH, protein, glucose, ketones, blood, bacteria.
11. Physical Exam
    (Rare and optional depending on results of above — often by paramedics more recently)

In a typical facility (the type often seen in airports, etc.), the patient logistics are highly structured and automated. The system computer (usually a mini) has multiple functions. Starting at registration, the patient is assigned a specific identification and basic accounting and demographic data are entered. Then blood tests are drawn in a lab or compartment and the patient enters a history-taking area (console) which is interrupt driven by the CPU. The patient continues on a computer-scheduled multiphasic encounter from station to station.

Different data and measurements constantly flow into the patient "file" as one progresses from start to finish. The computer receives digital data. Analog data is A/D converted and finally all collated and filed. Various measurements may require computation and autocalibration, all done by the system computer. Some facilities perform automated computer EKG analysis, others just add a tracing to the main file. All measurements are compared to "normals" and appropriate notations appear on the final report.

Who gets the results? This is often a problem. It depends on how a facility is integrated with other health programs. In many cases this was not well planned initially. Common "monitors" are personal physicians, company physicians, public health officials, insurance companies, and so on.

The technological virtuosity of both individual instrumentation, and system coordination via computer is quite remarkable. What is more remarkable is that in effect we had a "solution in search of a problem." The engineers got carried away with the challenge of producing a functional system, but the crunch came when everyone realized there was no line-up for the product! This is not to say no systems were sold, but the numbers were minimal and have yet to justify the vast development costs.

Is this another "Edsel" story? Not quite, but close, and the reasons are fascinating.

While the engineers were busy designing, and the marketing men were extrapolating, Dr. Collen and others were methodically doing

their HEW supported studies of serial AMHTs on fairly large populations. It slowly (1966-1976) emerged that yields of illness were disappointingly low, and in some cases no treatment was available for conditions which were "subclinically" detected.

What was most productive was the heretical notion that emerged that periodic health examinations may not play an important role in disease prediction or prevention. This may be hard to swallow for many of you, but it is a gradually developing belief of many medical economists. Since it represents "bread and butter" for a vast number of health professionals, it won't die easily!

Another major achievement has been the collection of massive "result norms" into a database which now provides a reference point not previously available. Indeed, the evolution of our knowledge of "Risk Factors" (particularly re: heart disease) owes a lot to these studies. From AMHT has come a more rational "Prospective Medicine." Here, instead of subjecting all patients to the same battery of screening tests, the most statistically significant tests are done based on an individual knowledge of personal and occupational and family history.

Hopefully, the scourge of cancer will be lightened eventually by early chemical or immunological screens, but we don't have the answers yet, and mass screening for some cancers is not possible.

The term "Preventive Medicine" is often bandied about. Within broad limits, we now believe certain conditions can be prevented, but these are mostly related to lifestyle (lack of fitness, obesity, alcohol, drug and cigarette abuse, accidents, etc.). Hypertension (high blood pressure) can be treated very well now and is a significant risk factor. Certain occupational illnesses can be prevented with care and vigilance, but many chronic illnesses cannot be cured, only controlled (diabetes, rheumatoid arthritis). Hopefully, the scourge of cancer will be lightened eventually by early chemical or immunological screens, but we don't have the answers yet and mass screening for some cancers is just not possible.

Although sophisticated statistical studies have gradually given answers to some questions, the role of AMHT is still unclear. It was established by the courts a few years back that any doctor who opens and reads the AMHT record of a patient is responsible for taking any necessary follow-up measures whether or not the information was unsolicited! Since this happened in many cases, the concept was not endeared in the minds of many unsuspecting physicians.

The response of patients is generally positive, as these "ministrations" are like the various mysterious rituals of religious orders. The people like it, but does it do any good? Is reassurance worth the cost? This remains to be seen. In Canada, AMHT never got started. Searle-Medidata, an early leader in this field, closed up shop after three or four fruitless years of flogging the process to various private and provincial parties.

The concept is not dead. Worldwide, there are some 200-plus facilities in operation. Japan seems the strongest proponent of the principle and has 50-odd units operating in a highly organized network. They believe the technique is a way of providing baseline health care to large populations, and they plan 500 facilities.

In the U.S., some AMHT programs exist in government, industrial and military environments, but it will take some time to decide whether there is a place for such techniques in the health systems. Many developing countries (especially the rich Arab nations) have purchased complete screening systems. It is a popular and benevolent gesture, which is very reassuring for patients. But under the glare of scientific analysis, the philosophy of the entire AMHT process is very shaky.□

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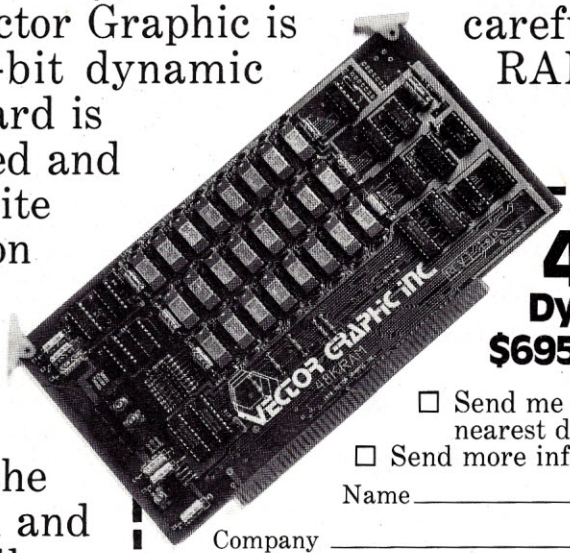

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THE MICRO-MATHEMATICIAN

By Dr. Alfred Adler

TABLE FOR HEX TO DECIMAL CONVERSION

As I check out a memory board or do some similar task requiring both front panel operations and the PEEK and POKE functions in BASIC, I often which there was a table for conversion from HEX to decimal. Such a table of course would be prepared, but if all 65536 addresses appeared on the table it would have to be at least 200 pages long. Various not-very-clever schemes have occurred to me, but they generally turned out to be not-very-convenient, and still ended up being 20 pages long.

The other day the following occurred to me. A single byte can be represented by a pair of HEX characters, and the decimal equivalents run from 0 to 255, and that can easily be put on one page. Now a 2-byte address consists of two such pairs (and the decimal equivalents run from 0 to 65535, and that is what is going to take 200 pages). However, the decimal equivalent of the left hand pair, that is, say 5F out of 5F3C, is always 256 (decimal) times what it would be if those same characters made up the right hand pair. For example, the 5F out of 5F3C has a decimal equivalent of $5 \times 4096 + 15 \times 256 = 24320$, whereas 5F out of 3A5F has a decimal equivalent of $5 \times 16 + 15 \times 1 = 95$, and 24320 is 256 times 95.

Therefore, all one has to do is make a 3-column table. Column 1 contains all HEX pairs from 00 to FF (256 in all). Column 3 contains their decimal equivalents; and column 2 contains the decimal equivalents times 256. To convert, for example, 5F3C to decimal, go down column 1 to 5F, and looking across to column 2, find 24320. That is the decimal equivalent of 5F00. Now go down column 1 again to 3C, only this time look across to column 3, finding 60. This is the decimal equivalent of 003C. Now just as 5F00 + 003C = 5F3C, so does 24320 + 60 = 24380. That is the decimal equivalent of 5F3C.

And it all goes on just one page!

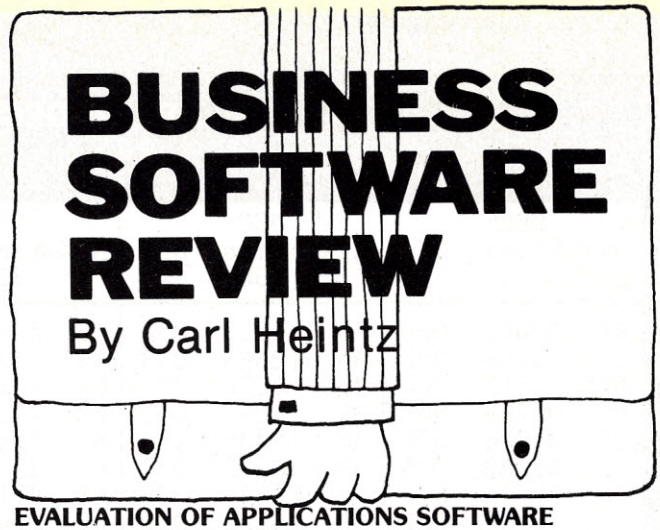
To review the rules; look up the left hand HEX pair in column 1. Its decimal equivalent appears opposite it in column 2. Look up the right hand pair in column 1. Its decimal equivalent appears opposite it in column 3. Add the two decimal numbers to get the decimal equivalent of the original 2-byte HEX number.

Obviously, but not quite as conveniently, the table also permits converting from decimal to HEX. Going down column 2, find the largest decimal number equal to or less than the decimal number to be converted to HEX. Looking across to column 1 gives the corresponding left hand HEX pair. If we subtract the number chosen in column 2 from the original decimal number to be converted, the decimal number that must be represented by the right hand HEX pair is found. Going down column 3, find this number, and opposite it in column 1 find the corresponding right hand HEX pair. For example, to convert 24380 decimal to HEX, go down column 2 to 24320, which is the largest number equal to or less than 24380. Opposite 24320 we find 5F in column 1. Subtracting 24320 from 24380, we get 60. Going down column 3 to 60, and looking across to column 1, we find 3C. Thus the HEX equivalent to 24380 is 5F3C.□

For those who have specific questions regarding math functions and the computer, Dr. Adler can be contacted by writing to Dr. Alfred Adler, 10360 E. Flintlock Tr., Tucson, AZ 85715. Dr. Adler will make every effort to either answer you directly or within the column.

HEX TO DEC CONVERSION

HEX	DEC times 256	DEC	HEX	DEC times 256	DEC	HEX	DEC times 256	DEC	HEX	DEC times 256	DEC	HEX	DEC times 256	DEC
00	00000	000	34	13312	052	68	26624	104	9C	39936	156	D0	53248	208
01	00256	001	35	13568	053	69	26880	105	9D	40192	157	D1	53504	209
02	00512	002	36	13824	054	6A	27136	106	9E	40448	158	D2	53760	210
03	00768	003	37	14080	055	6B	27392	107	9F	40704	159	D3	54016	211
04	01024	004	38	14336	056	6C	27648	108	A0	40960	160	D4	54272	212
05	01280	005	39	14592	057	6D	27904	109	A1	41216	161	D5	54528	213
06	01536	006	3A	14848	058	6E	28160	110	A2	41472	162	D6	54784	214
07	01792	007	3B	15104	059	6F	28416	111	A3	41728	163	D7	55040	215
08	02048	008	3C	15360	060	70	28672	112	A4	41984	164	D8	55296	216
09	02304	009	3D	15616	061	71	28928	113	A5	42240	165	D9	55552	217
0A	02560	010	3E	15872	062	72	29184	114	A6	42496	166	DA	55808	218
0B	02816	011	3F	16128	063	73	29440	115	A7	42752	167	DB	56064	219
0C	03072	012	40	16384	064	74	29696	116	A8	43008	168	DC	56320	220
0D	03328	013	41	16640	065	75	29952	117	A9	43264	169	DD	56576	221
0E	03584	014	42	16896	066	76	30208	118	AA	43520	170	DE	56832	222
0F	03840	015	43	17152	067	77	30464	119	AB	43776	171	DF	57088	223
10	04096	016	44	17408	068	78	30720	120	AC	44032	172	E0	57344	224
11	04352	017	45	17664	069	79	30976	121	AD	44288	173	E1	57600	225
12	04608	018	46	17920	070	7A	31232	122	AE	44544	174	E2	57856	226
13	04864	019	47	18176	071	7B	31488	123	AF	44800	175	E3	58112	227
14	05120	020	48	18432	072	7C	31744	124	B0	45056	176	E4	58368	228
15	05376	021	49	18688	073	7D	32000	125	B1	45312	177	E5	58624	229
16	05632	022	4A	18944	074	7E	32256	126	B2	45568	178	E6	58880	230
17	05888	023	4B	19200	075	7F	32512	127	B3	45824	179	E7	59136	231
18	06144	024	4C	19456	076	80	32768	128	B4	46080	180	E8	59392	232
19	06400	025	4D	19712	077	81	33024	129	B5	46336	181	E9	59648	233
1A	06656	026	4E	19968	078	82	33280	130	B6	46592	182	EA	59904	234
1B	06912	027	4F	20224	079	83	33536	131	B7	46848	183	EB	60160	235
1C	07168	028	50	20480	080	84	33792	132	B8	47104	184	EC	60416	236
1D	07424	029	51	20736	081	85	34048	133	B9	47360	185	ED	60672	237
1E	07680	030	52	20992	082	86	34304	134	BA	47616	186	EE	60928	238
1F	07936	031	53	21248	083	87	34560	135	BB	47872	187	EF	61184	239
20	08192	032	54	21504	084	88	34816	136	BC	48128	188	F0	61440	240
21	08448	033	55	21760	085	89	35072	137	BD	48384	189	F1	61696	241
22	08704	034	56	22016	086	8A	35328	138	BE	48640	190	F2	61952	242
23	08960	035	57	22272	087	8B	35584	139	BF	48896	191	F3	62208	243
24	09216	036	58	22528	088	8C	35840	140	C0	49152	192	F4	62464	244
25	09472	037	59	22784	089	8D	36096	141	C1	49408	193	F5	62720	245
26	09728	038	5A	23040	090	8E	36352	142	C2	49664	194	F6	62976	246
27	09984	039	5B	23296	091	8F	36608	143	C3	49920	195	F7	63232	247
28	10240	040	5C	23552	092	90	36864	144	C4	50176	196	F8	63488	248
29	10496	041	5D	23808	093	91	37120	145	C5	50432	197	F9	63744	249
2A	10752	042	5E	24064	094	92	37376	146	C6	50688	198	FA	64000	250
2B	11008	043	5F	24320	095	93	37632	147	C7	50944	199	FB	64256	251
2C	11264	044	60	24576	096	94	37888	148	C8	51200	200	FC	64512	252
2D	11520	045	61	24832	097	95	38144	149	C9	51456	201	FD	64768	253
2E	11776	046	62	25088	098	96	38400	150	CA	51712	202	FE	65024	254
2F	12032	047	63	25344	099	97	38656	151	CB	51968	203	FF	65280	255
30	12288	048	64	25600	100	98	38912	152	CC	52224	204			
31	12544	049	65	25856	101	99	39168	153	CD	52480	205			
32	12800	050	66	26112	102	9A	39424	154	CE	52736	206			
33	13056	051	67	26368	103	9B	39680	155	CF	52992	207			



EVALUATION OF APPLICATIONS SOFTWARE AND A LOOK AT A REAL PRODUCT

In last month's column we looked at some of the attributes of a good operating system. This month we'll investigate the characteristics which make applications software desirable, and feature the series of programs known as "Payroll with Cost Accounting" written by Lon Poole and Mary Borchers, published by Osborne & Associates.

Applications programs are those programs, usually written in a higher level language, such as BASIC or FORTRAN, which get the job done. They are "task oriented," as opposed to the operating system, which is the "personality" of the machine. Yet the two programs are interwoven in the machine, and thus compatibility of program to operating system is a primary consideration. So when an operating system is chosen, be sure that it's not a one of a kind, or the job of obtaining software will be doubly difficult. CP/M, North Star's Horizon and Micropolis' disk are some of the common operating systems. However, don't overlook some of the systems which have been designed by manufacturers for their own hardware — as long as you know you'll be able to get all the programs you desire.

Compatibility with a particular operating system usually entails the use of a particular dialect of BASIC. There are at least as many dialects of it as there are dialects of Chinese — be sure your machine speaks the same one as your applications program.

PROGRAM ATTRIBUTES

Unfortunately, there is some divergence of opinion on some of the attributes, so what follows is my opinion. The keys for any applications program are:

1. Program applicability to the job
2. Documentation of program
3. User manual documentation
4. Error recovery documentation
5. System safeguards and security
6. Program output content/readability
7. Program efficiency and speed
8. Program architecture

Obviously, the first consideration is whether the program will do the job. The best way to be certain that an applications program will be suited to your application is to interface with the personnel who will be using it. Engineering departments should be able to specify their program requirements. A good source of advice should be the company's CPA. Since in many cases he'll be auditing the program output at year end, some worthwhile input from him may save money and headaches in the end.

One word of caution, based on experience — don't over computerize. Many businesses forget that there is a trade-off on automation, and a cost effectiveness which sometimes makes manual systems more effective than their computer counterparts. A great example of this is in payroll — if you've got 20 employees paid bi-weekly, it would probably be faster and easier on a one-write manual system.

DOCUMENTATION

Recently I spoke with the owner of a computer store who was attempting to get a program up and running. He had loaded the program, but the program supplier had neglected to tell him of the password, and how to change it. Somehow the password got changed and no one knew what it was, how to determine it or what to do. he couldn't get a hold of the author and couldn't figure out how to

resolve the problem. Don't get yourself in a similar situation; be sure that your documentation is sufficient.

Evaluating documentation is tricky. There are many variables and it's the sort of situation in which it's what they don't tell you that will get you in trouble. Don't forget that there are two different types of documentation — the program itself, and the operator's manuals. Both are vital. The program documentation should allow you, as the user to fully understand what the program does and how it does it. Necessary ingredients in the documentation of any good program are record layouts, flowcharts, system description, and a description of what each program does.

A program listing is always valuable and should be generally insisted upon. Realize, however, that such a listing can be next to useless unless it has some sort of commentary explaining what is happening at each step.

The preceding commentary entails the interpretation of code. Many a small business user wants to read code less than he wants to climb Mount Everest. And for many, it may be almost as difficult. But without code, no one but the vendor can get down to the basics of what the program is doing. This may be vital if the program blows, or if changes are desired in the program at a later date.

Error recovery documentation is vital. Don't depend upon your own ingenuity to get yourself out of a scrape. Remember, your own logic may not correspond to that of the machine. Proper error recovery documentation should describe in lurid detail how to extricate yourself from even the most stupid blunders. Remember Murphy's Law — in micros, an error is not just probable; it will, has, and probably did already occur.

SAFEGUARDING THE ASSETS

System safeguards are a fundamental aspect of any good micro application program. Remember that microcomputers introduce a certain degree of internal control weakness into the system. That may sound alarming, but contrary to what most businessmen intuitively feel, it's true. Consider the ease with which a micro can be reprogrammed. Consider the advantages of a computerized payroll system to the larcenous mind. The opportunities for fraud are endless. There has been a lot of discussion in literature of the CPA profession about the problems which can occur.

Whenever a micro comes into the office, one of the tradeoffs which must be accepted is the possible weakening of certain aspects of internal controls. One can circumvent these weaknesses, however, through a concerted security program. Hardware controls (using keys to the computer, restricting users from getting hold of the programs and using a run meter with a daily log) should be used in concert with effective software controls. Software controls such as passwords and logs of what the computer did on each job are important. Security in the programs is important. If users can modify files at will, make "one-sided" entries, create and destroy files with no documentation on a hard copy print out, then the system has severe problems and is an opportune situation for the thief.

OUT WITH OBSCURE OUTPUT

Hooray for reams of computer printout paper. Yes, you too can have a paper mill, with pages upon pages of meaningless output. Impress your banker with the stacks of paper. But don't run your business that way. When investigating any applications program, look at the output and see whether it is concise, readable and suits your needs. It's a plus if the program runs on 8½ x 11 paper (80 column) since the 132 column paper is a bear to store without special binders. File drawers, shelves and the like were never designed to accommodate them. Look for schedules which are organized simply, with lots of space, readability and proper labeling of all amounts.

A REAL WORLD SYSTEM

Now that you have the author's biased feelings on evaluating applications programs, it's time to jump into the evaluation of a real product, "Payroll with Cost Accounting," published by Osborne & Associates. This program comes as a set of program listings with an extensive set of documentation.

To the uninitiated, the book may seem at first glance to be the best bargain in town. Where else can one obtain a complete and comprehensive payroll program for $12.50? The facts of the matter are, however, that the book is not what a casual reader may assume. The introduction says, "We do not expect many people to be able to use these programs exactly as they were written." Thus the book is more along the lines of a source book of ideas for the programmer; a jumping off place from which the reader can develop his own payroll programs.

The programs are written in Wang BASIC, which is a unique BASIC, not compatible with anything but the Wang computer. For another monkey wrench, the programs make extensive use of special function keys which Wang computers and other similar systems use to delineate certain program functions. The programs are thus in need of major modification to run on some of the more popular micros.

Before I go any further, let me comment that there are several software houses around which have taken the Osborne programs and converted them to run on CP/M or other compatible systems. Thus, it is possible to buy the programs, or replicas, on a magnetic media in a form compatible with many common operating systems.

THE PROGRAMS

To begin with, it is my impression that the Osborne programs are complex. There are 34 subprograms, which utilize 13 different types of files. There is a specific protocol for using these programs, too. If the programs are run out of sequence, disastrous results can occur. And, as the book points out, if you goof and run the wrong program, "you will have to determine various file statuses and use your ingenuity to formulate a recovery plan." That sounds like trouble. How much more complex would it have been to incorporate some idiot-proofing so that certain programs could not be run before others?

The documentation for the programs is very nice — in fact it is super. The layout of all the files is adequately demonstrated, and the program listings are full of descriptive comments.

The programs themselves are flexible. For example, you can enter a hand-written payroll check or have the computer produce one for one or more employees. The programs allow employees to have different state and federal exemptions, and even have two files for state exemptions.

The programs are designed for entry of data on a daily basis and preparation of payroll on a bi-weekly basis. However, the entry of data can be only once during a payroll period, or as many times as is necessary.

The programs have some shortcomings. Nowhere in the program architecture has a provision for accounting for sick pay been given consideration, although they do have a "health and welfare pay" which is similar. On the other hand, the computer very nicely shows how much vacation time is remaining for each employee.

The history files show transactions for the entire year, for lots of the detail. I'm convinced that much of this data, for all but a few applications, could have been deleted. After all, for payroll tax purposes, the salaries and deduction year-to-date totals are all that need be maintained.

The authors are very helpful in giving some useful hints about how the programs contained in the book could be modified to accommodate various situations. This feature again reinforces the concept that the programs contained in the book, except for a few applications, probably will not be adaptable directly to the user's computer.

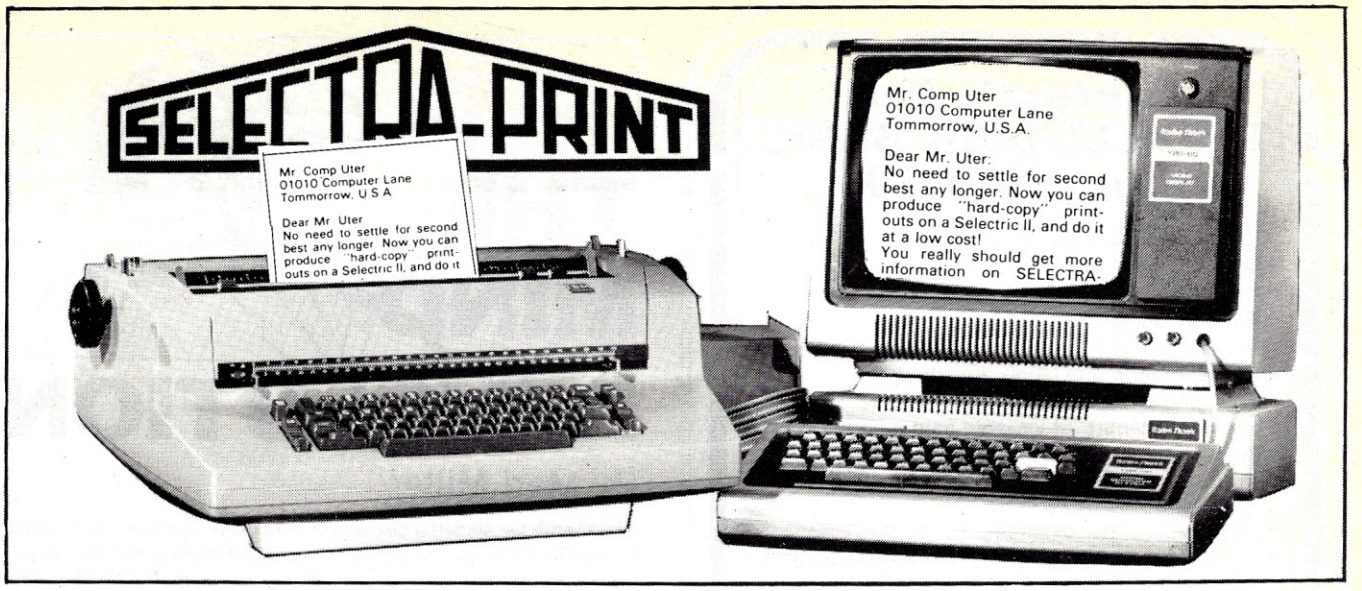
The type of payroll programs described in the book are most applicable to a job shop manufacturing plant, where payroll data must be accumulated by individual project. The programs do a nice job and the output is enough to satisfy most any cost accountant.

I was a bit disappointed, however, in the accounting end. I would like to see an output which would make the job of making the journal entries to record the payroll easier. This seems to be the bane of computerized payroll systems, though.

In terms of report content and presentation, the book's programs beat any Bank payroll system and most of the microcomputer payroll systems I've seen. The reports are intended for human consumption; they are very readable and quite well organized.

I am a bit concerned about the complexity involved in running the programs. The average payroll clerk may have quite a time learning to use the complex programs in this book. They require some thinking while the terminal is there in front of you. There are numerous ways around this, such as the use of "input forms" instead of so many menued formats. In other words, the process of processing the payroll could have been simplified, to some degree, from an operator standpoint.

In summary, the Osborne book presents a very impressive payroll package, with some sophisticated options. It is obvious that a great deal of thought and consideration went into the design and formulation of the programs. I detect the input of an experienced payroll processor. The results are certainly a significant set of programs. The Osborne book is useful even if the user decides to purchase someone else's programs which are more suited to his particular operating system and equipment configuration because it serves as a good benchmark by which to judge other systems.□



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THE MIND REVOLUTION

By Merl Miller

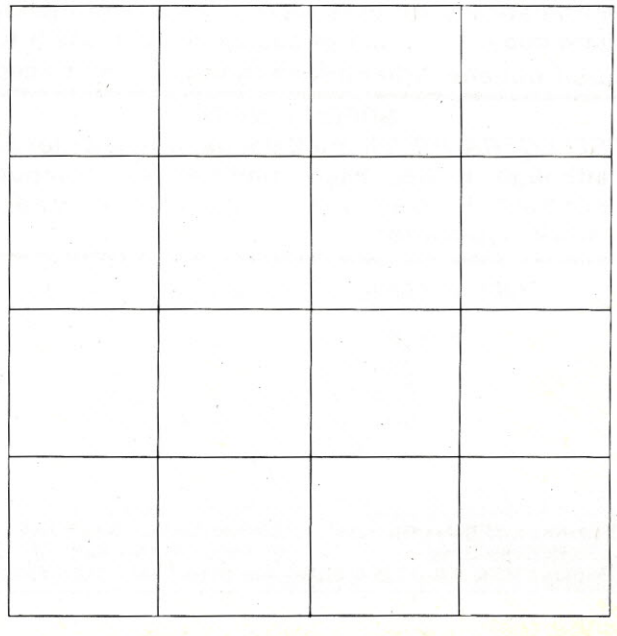
Last month we started a discussion of how the eye sees. This month I would like to relate that problem to artificial intelligence. As this column is, by necessity, too short to prove any mathematical theorems or develop any concrete proposals, I will stick to some basic ideas.

The most interesting aspect of the study of vision is that we can describe the behavior of cells but cannot explain why they act the way they do. Perhaps the best way to solve this problem is to view it as a problem in information processing.

Let's start by considering a specific image area. Try this yourself. Draw a square box with four-inch sides. Now, using a pencil, draw three lines exactly one inch apart. The first line will be one inch from the top. Do the same thing starting from either side. You should now have a large box with 16 smaller boxes inside. Obviously, you could form some interesting patterns by just filling in some of the boxes. In fact, there are 2^{16}, or 65,536, possibilities. Amazing, isn't it? Much more amazing is the fact that, even with all those possibilities, you still have a very simple pattern. If you want to show anything intricate, you will need a much greater scale.

Suppose the scale used is dots, rather than boxes, and we put 1,000 dots on each side of our square. We could do this in a binary manner; that is, we could make each dot either dark or light. Now, all we have to do is teach the computer to recognize each of the dot patterns. Right? Wrong! It would take a lot of memory to store the data for four dots on the side. Imagine what it would be like if we stored $2^{1,000,000}$ dots per side. If you have trouble imagining the size of this number, try this; just doubling the first box yields a number larger than 18 quintrillion. It is obviously impossible to store all this information, so we must derive a better method.

The better method in this case is approximation. In any image there are areas of darkness and lightness. You can create this with only black and white dots if you have enough of them and they are



small enough. A simple optic cell has the capability of measuring this light intensity over several field sizes. Consequently, the cell can distinguish a pattern of light over a group of fields. These images are somehow presented to the cerebral cortex in an interrelated manner. This would seem a possible approach for machine vision and some people are trying to do it this way. However, a lot of others aren't.

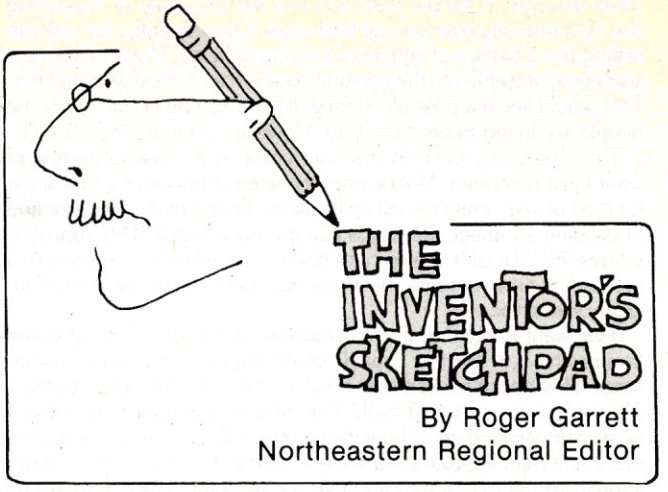
The classic approach to machine vision is the exact opposite of what I just described. Most computer researchers believe that some method of segmentation will yield vision. Segmentation is a method of dividing an image into areas that are meaningful. This approach utilizes the "if it isn't one of these things, it must be. . ." approach. It probably works in some instances but there has to be a high incidence of error.

If we want to build a machine capable of the same kind of vision humans have, it must be capable of solving the same types of problems. This doesn't mean that it solves them in the same manner. The only way we could build this type of machine is to have a greater understanding of how it all works. I don't believe segmentation is the right approach but we will need to know a lot more about approximation before we can build the machine. A lot of what I've read concerning these two approaches seems to emphasize the differences. It would sure seem there ought to be a third approach. Perhaps this could be better understood if we examined artificial intelligence a little bit.

Some people believe artificial intelligence should be the study of information processing that has its roots in biology. Others believe artificial intelligence should be a study of creating a totally new intelligence. I belong to the latter group. In either case, the primary goal, at this point, should be to identify useful information processing problems and give an abstract account of how to solve them.

Our emphasis must be on the problem solving. This can best be done by devising algorithms, asking well-thought-out questions. We need to devise the best possible system for doing this. I hope that emphasis will move more and more to the problem aspect.

There are some interesting questions that need answers. The first, of course, are: "What is the ultimate goal of artificial intelligence?" and "Can we create a machine capable of expanding man's mental capacity?" What do you think?☐



By Roger Garrett
Northeastern Regional Editor

A TOUCH SENSITIVE PANEL

Computers really become entertaining and workable tools when the man-machine interface is simplified. Rather than using the all-too-typical keyboard and printer, you become more directly involved with the processing power of the computer when you can use more direct human-oriented I/O such as voice control, joysticks, or touch-sensitive screens.

Touch-sensitive screens; what are they? Well, there hasn't been much written about them, so I will give you a brief description and then present a modification and (what I like to think of as an enhancement to) a simple form of touch-sensitive screen.

Typically, a touch-sensitive screen (TSS) is used in conjunction with a CRT-like (i.e., television-like) screen that displays some graphic or textual information. The operator can then touch any part of the screen, either with his finger or a special light-sensitive or acoustic pen, and the computer can determine, via appropriate hardware/software magic, what part of the screen was touched.

Using such a system and appropriate software the operator could, for example, make dynamic design changes to computer-generated architectural structures, edit manuscripts, "paint" pictures, or compose music simply by touching appropriate portions of the screen and "moving" objects around on the screen.

Acoustic pens emit ultrasonic beeps when they are touched to the screen. Highly sensitive microphones positioned around the edges of the screen pick up the beep and, based upon the time it takes for the sound to get from the pen to the microphones, the computer can determine the spot (the x and y coordinates) on the screen that was touched.

Light-sensitive pens actually detect the presence of a spot of light on the CRT. In order for the computer to determine the position of the pen, it momentarily darkens the entire screen. It then sequentially turns on each point on the screen (typically a 256 x 256 grid of points). When it turns on a point, it checks to see if the pen is detecting any light. If it is, then the computer knows exactly what spot, and hence the x,y coordinates, of the tip of the pen.

If the pen isn't sensing any light, the computer darkens that spot and moves to the next spot. When it is all done it restores the original picture to the screen. Of course, this all happens faster than you can see it and there are methods of simplifying the process. But that is basically how it works.

There is another relatively new form of touch-sensitive screen, one that is truly touch-sensitive. In essence it is an array of optically clear buttons bonded to a glass or plastic plate fastened in front of the display screen. Clear buttons? Well, not exactly buttons. The plate is covered with an array of clear conductive epoxy (or other suitable clear conductive material) square pads, each one electrically isolated from the adjacent pads.

Individual connections are made to each pad, either by clear conductive epoxy channels or nearly invisible wires. By touching a pad, you change its capacitance, since you are, in effect, adding the mass of your body to the mass of the pad. The computer can detect the change in capacitance and, once again, determine what part of the screen is being touched.

Well, so much for the sophisticated methods. Let's get on to Figure 1 and probably the simplest way of making touch-sensitive screens.

FIGURE ONE

In this form of touch-sensitive screen the computer detects the breaking of a beam of light by a finger, a pointer, a pen, or any other object and thereby determines its x,y coordinates.

In this figure, there is a frame with light-emitting diodes on the inside lower and right sides and light sensors on the inside opposite sides. Each LED and light sensor is capped with a lens, producing the effect of a beam of light from each LED straight across the frame to its corresponding light sensor.

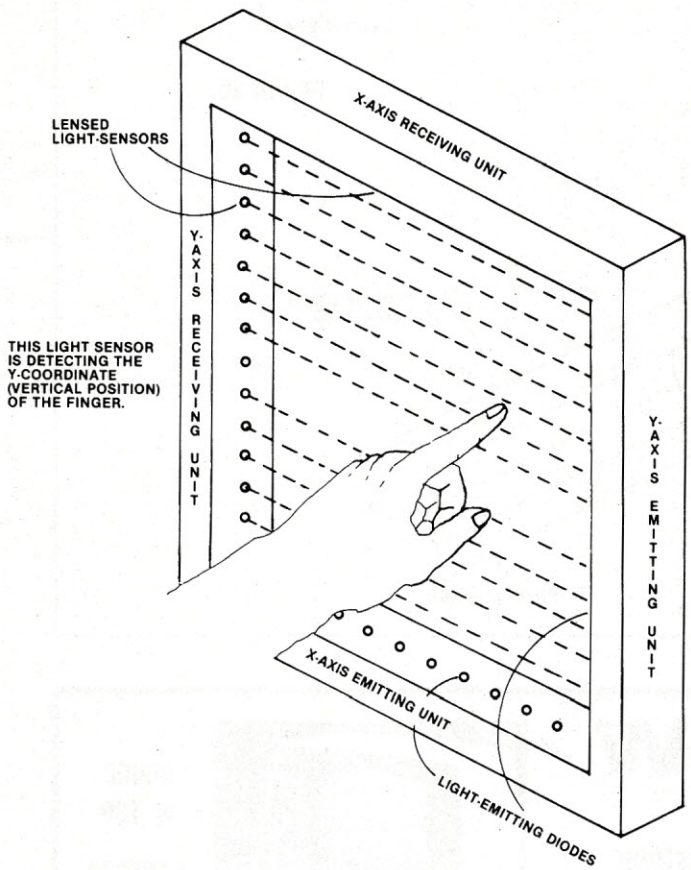


Figure 1.

I have indicated the horizontal beams with dashed lines and have not indicated the vertical beams at all, in order to simplify the picture. Just keep in mind that what applies to the horizontal beams also applies to the vertical beams.

This unit would be placed in front of the display screen. When you point to an object on the screen, your finger intercepts one or more horizontal beams so that the light sensor for those beams no longer senses any light. In this figure, the finger has intercepted one horizontal beam about midway up the screen. Since the computer knows the relative placement of each light sensor and can detect which sensors are not receiving a light beam, it can determine the y-coordinate of the finger. Since the same principles apply to the vertical beams, the computer also determines the x-coordinate and thereby knows the exact position of the finger and, hence, what you are pointing at.

I said *exact*. Of course we understand that exactness is relative. The closer we space the LEDs and sensors, the more accurately we can determine the placement of the finger or pointer.

If we are using a pencil to point at figures on the display screen, or if we want to be able to select an object from several very closely positioned objects on the display screen, or if we want to make the display and touch-sensitive screens very large, we will have to use a very large number of individual LEDs and sensors. That would quickly get quite expensive and involve a good deal of circuitry.

So here are my ideas for improvement.

FIGURE TWO

Let's replace the row of individual LEDs with one light source, say a neon or fluorescent tube. Position it over a base which has been drilled with holes as in Figure 2a. This we shall call a *light emitting unit.* Since the fluroescent tube is positioned directly above the row of holes, light passes straight through them, forming a light beam from each hole. Figure 2b shows a cutaway view of one hole and its resultant beam. So we have replaced a large number of LEDs with one lamp and a bunch of holes.

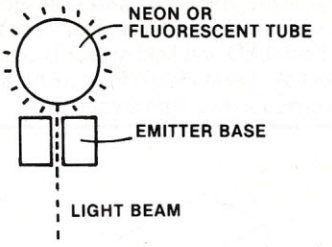


Figure 2b.

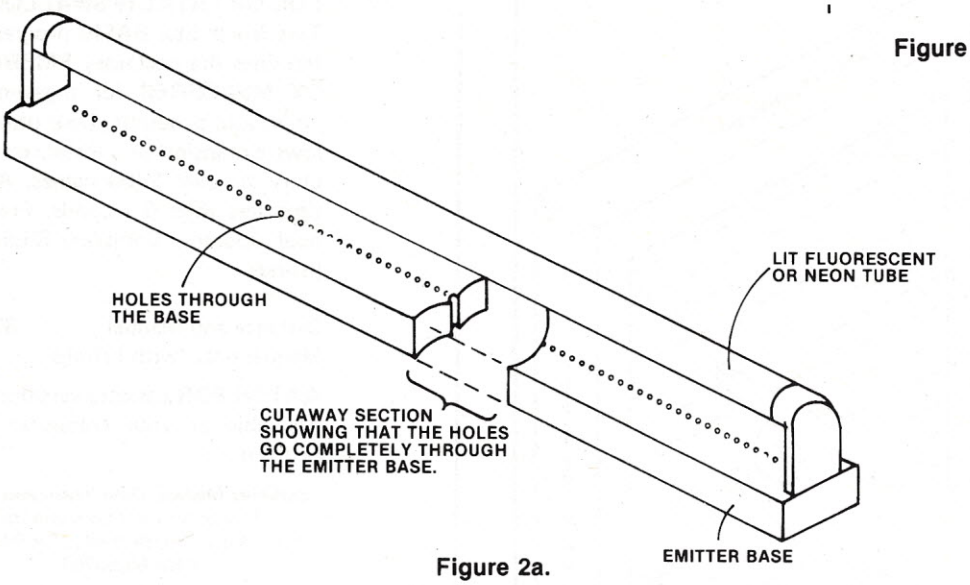


Figure 2a.

FIGURE THREE

A long row of discrete light sensors doesn't make for very sophisticated engineering design in today's world of integrated circuits. So let's replace them with a recently available product, a light-sensor array in a DIP. These devices have a linear array (i.e. arranged in a row) of light-sensitive elements. By using such a device we eliminate a substantial number of discrete components as well as the addressing circuitry necessary to individually access them.

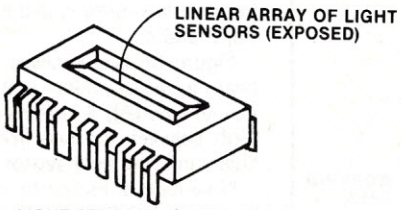


Figure 3.

There is a problem here, however. The DIP is rather small; the sensor array is barely an inch in length while we assume the viewing area of the screen and, hence, the width of the light-emitter unit, is eight inches or more. Either we need a lot of DIPs (defeating our purpose for eliminating the discrete sensors) or . . .

FIGURE FOUR

. . .we *focus* the row of light beams coming from the light-emitter unit onto the light sensor array. Each individual beam illuminates one element of the sensor array in the DIP. Notice that, since the light rays are all in one plane, the lens focuses in only one direction. This means we can use a relatively skinny lens.

There is a problem with this setup, however: the *reception unit,* made up of the lens and light-sensor array, could occupy an area as large as the working area (the touch-sensitive area) itself, resulting in a completed unit looking something like Figure 5.

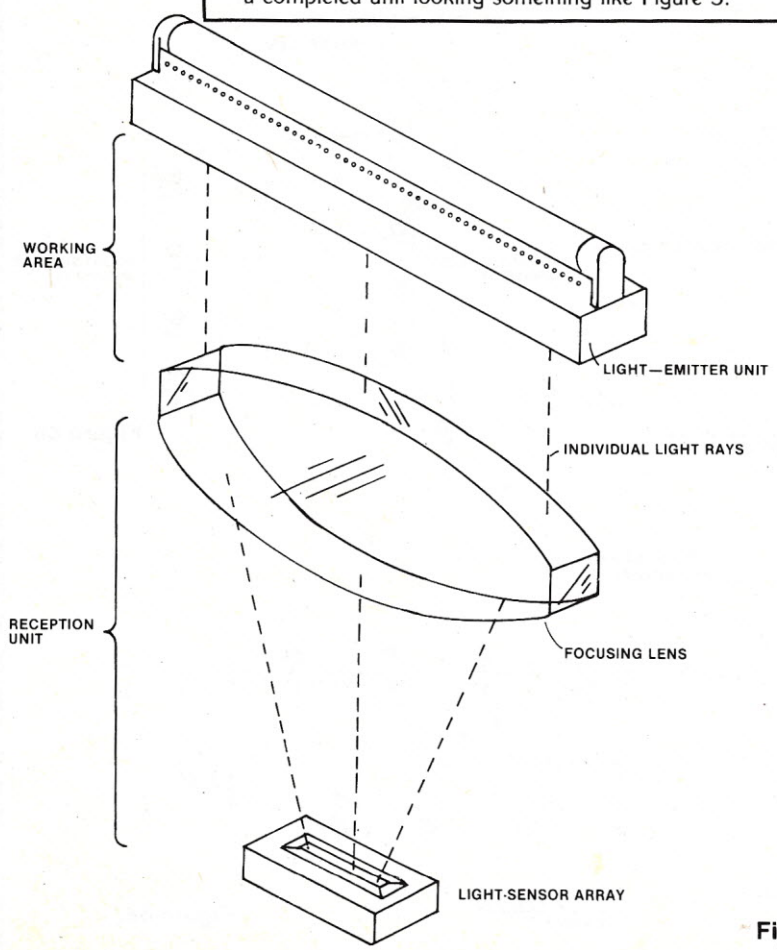


Figure 4.

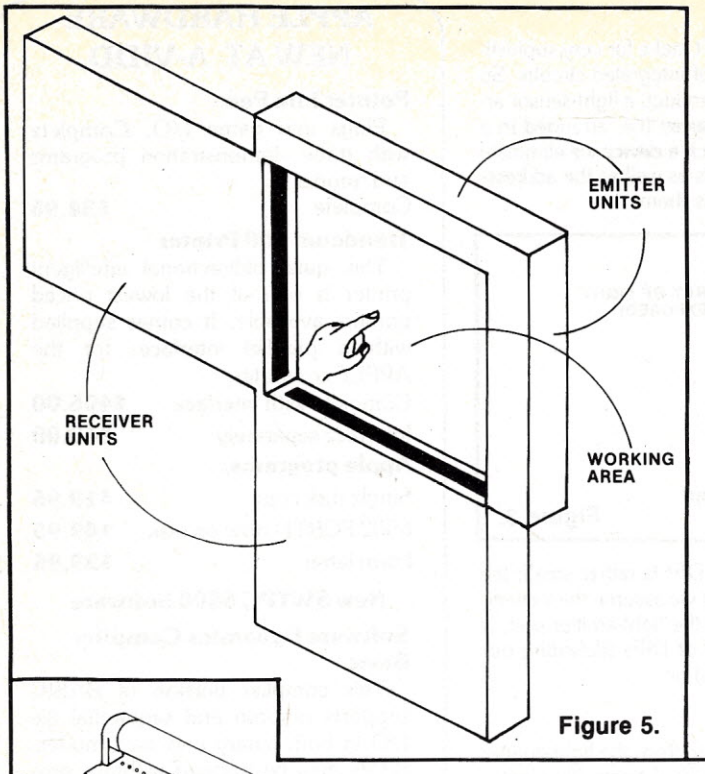


Figure 5.

FIGURE FIVE

While we could make do with such a device, if we want to make units with very large working areas then the unit grows to ungainly proportions. So . . .

FIGURE SIX

. . .we employ a few tricks. First of all we replace the normal style lens with a fresnel lens. This type of lens is made up of a large number of lens segments compressed into a relatively flat package. Beneath the fresnel we place a right-angle prism, two opposing front-surface mirrors, and the light-sensor array as shown in Figures 6a, b and c.

Figure 6b is a cutaway side view of the receiving unit. A light beam from the emitter unit enters from the top, passes through the fresnel lens (A), is deflected by the prism (B) to bounce back and forth between the two front-surface mirrors, (C) through (I), and finally into the light sensor array (J).

Now look at Figure 6c and it should become clear what is happening. In this figure we follow the same light beam as in 6b. Notice that the beam originates from the right hand side of the emitter unit (see 6a). The beam enters the fresnel lens at (A) which focuses it towards the light-sensor array, (i.e. from (B) through (J) it travels to the left). What we have done is taken the light path from the lens to the sensor array, which takes up so much room in Figure 4, and folded it up so that it requires a minimum of space. Each light beam still illuminates one element of the sensor array, it just doesn't require as much room to do it in.

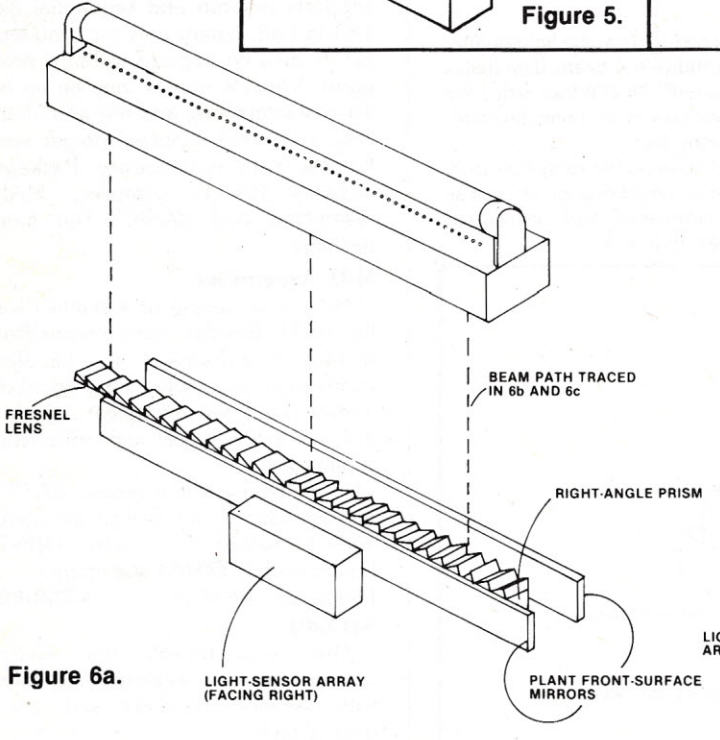


Figure 6a.

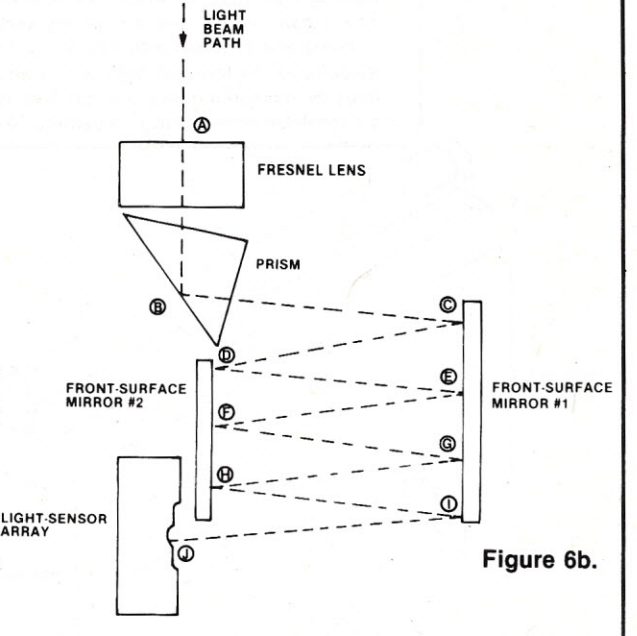


Figure 6b.

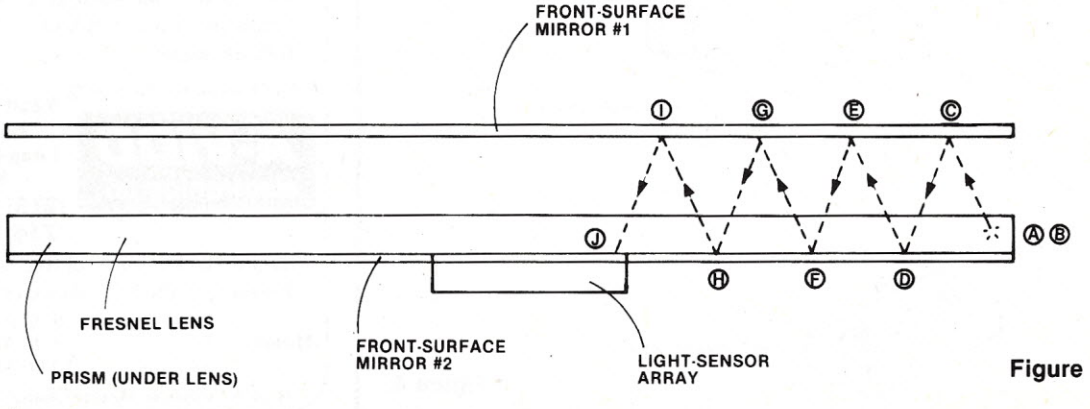


Figure 6c.

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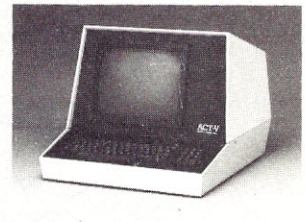

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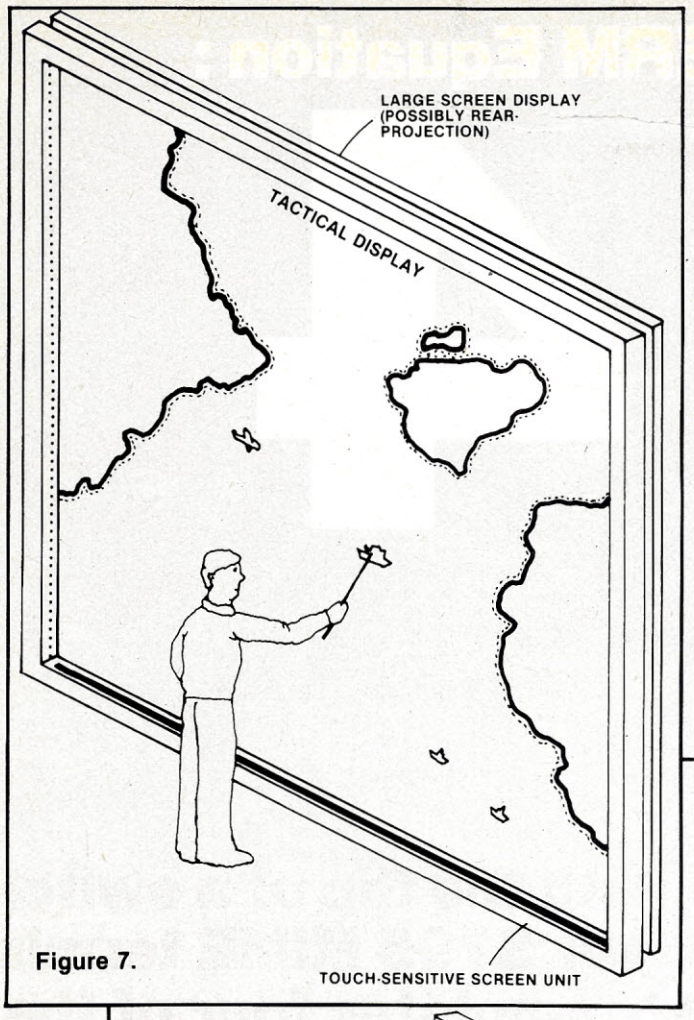

Figure 7.

FIGURE 7

So there we have it. The unit has been considerably simplified, providing for easier and cheaper assembly and production yet with increased resolution. The units can be made as large or as small as the application requires. There is no need for special acoustic or light pens; any pointer will do. There is no extra clear panel to place in front of the display as is the case with the capacitive touch-sensitive unit, so . . .

FIGURE EIGHT

. . .the unit can be utilized in non-display setups. For example, by setting up several such units in a row the trajectory of a missile (in this case a bullet fired from a gun) could be followed by detecting the time and x,y coordinates as it passes through each unit. Such a setup might be used to evaluate the effects of different projectile shapes or propulsion systems on trajectories.

FIGURE NINE

This touch-sensitive panel could even have applications in sports. With an emitter and receiver unit straddling the jump-off line and the landing pit, a computer could accurately and instantly determine the distance obtained by an athlete performing the long jump. Rather than the current method in which the measurement is taken from a 'foul line' to the imprint left in the sand in the landing pit by the athlete's foot (admittedly an inaccurate method), the touch-sensitive panels would measure the actual total distance from the point of take-off to the point of landing.

And the applications go on and on and on.□

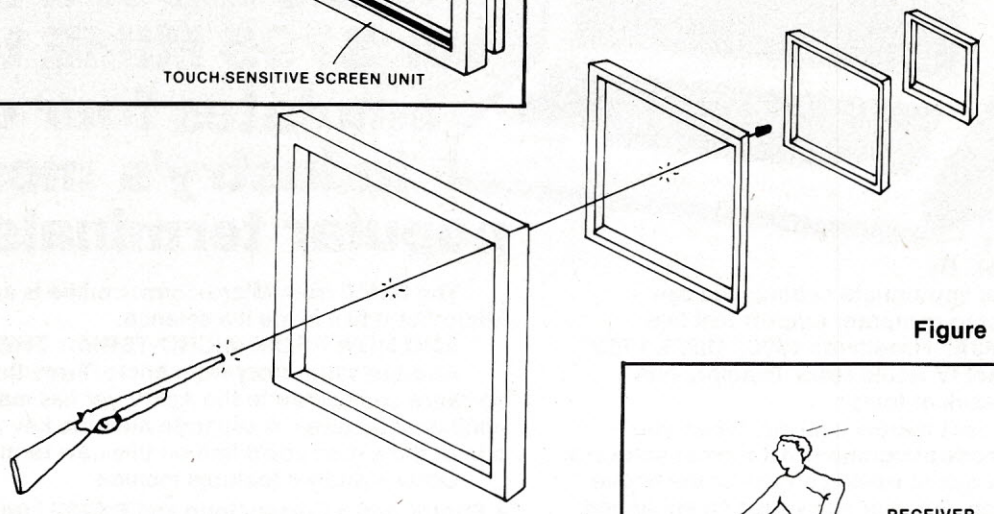

Figure 8.

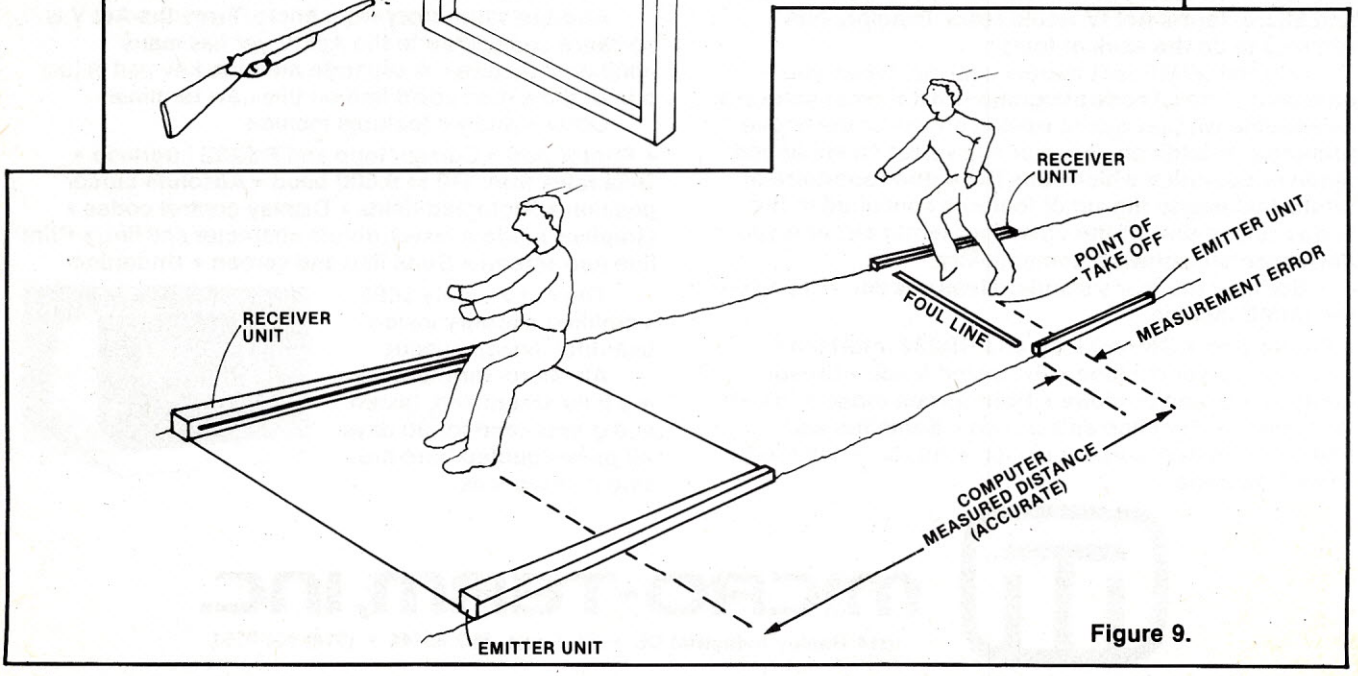

Figure 9.

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Curing the Music Business Blues

By Terry Costlow, Assistant Editor

PHOTOGRAPH BY SHELLEY WRIGHT

Portable telephones, a TRS-80 computer, several digital clocks and sophisticated recording equipment — electronic machines in plastic packages — sit in contrast to the highly polished wood and strings of the pianos in the life of concert pianist Peter Nero.

Most widely known for his soundtrack of "Summer of '42," a recording that earned him a gold album in 1972, Nero has been fascinated with technology since he watched Flash Gordon and Buck Rogers movies while growing up in New York in the 40s. During the 1960s, when some of the fantasies of those movies began to become realities, the popular musician began to think that some of that wizardry could help him handle his blooming musical career. After he won a Grammy for the Best New Arist in 1961, and garnered another the following year, contracts and travel arrangements started to become as much a part of his life as playing the piano.

Unlike many musicians who play long dates in nightclubs or rock performers whose tours are arranged by a third party, Nero plays a variety of concerts. Sometimes he and his two-person backup band perform; on other dates he conducts an orchestra, while on still others he simply plays with the orchestra as a guest artist, either with or without his band. Each performance requires a separate contract.

After looking at minicomputers but deciding they were too expensive for his needs, Nero again became interested when micros became available.

"Once my touring season starts, I'm doing over 100 engagements. Every engagement becomes a big production when you're doing that many," Nero explains. "It gets to be a mire of details keeping track of everything and making sure all the instruments and outfits are there on time."

Arranging from 100 to 300 of these dates each year and keeping track of the travel arrangements quickly leads to a blizzard of papers and contracts, compounded by the fact that several different people need copies of different parts of the information. Although he has managers, agents and other people taking care of things, Nero likes to keep track of what's being done.

"I'm kind of a do-it-yourselfer," he says. "When people ask me why my managers don't do the stuff, well, they could. But as good as they may be, I still have to know what's going on. Sometimes I'm on the phone and someone will ask me something. I could tell them myself in less time than it would take to find out from someone else."

He is currently testing a new program developed specifically for him by Micro-80 of Garden Grove, California, that will take care of much of this record keeping and type copies of everything. Not only will everything be kept in one central location for easy access, but copies for different people can be printed out in much less time than it would take a typist to do them. Nero can decide which information must go to each person, then simply punch in the proper program and the computer will print up the necessary information.

For example, financial records of each concert must be made in a variety of different ways for the different people who need them. When 2,500 to 3,500 tickets are sold each night, the amount of money coming in and going out becomes very complex. Some people, such as the bookkeeper and manager, need to know all the financial details. Others only need the part they are concerned with. The owners of an auditorium or directors of the orchestra don't need the information about plane fares and hotel rooms. And the musicians probably don't care about any of that if their rooms and flights are okay and their paychecks come on time.

"When I want to see how I'm doing, I'll be able to look at the computer and see what percentage of my money is going to travel, which percentage is going to hotels. . . I've never been able to do that before," Nero says.

Having a computer keep track of all this information is a dream come true. "I've wanted to do this for 20 years," the 44-year-old says of using a computer to take care of the business of touring. "When micros started becoming popular, it became affordable."

After looking at minicomputers but deciding they were too expensive for his needs, Nero again became interested when micros became available. He checked out the first system he heard about, but found it couldn't meet his needs. Shortly thereafter, he heard about Radio Shack's newly developed computer system.

His trip to Tandy headquarters in Texas proved to be worthwhile. In September, 1977, Nero bought one of the first units that came off the line.

"I've got one of the first ones they made. I looked at the serial number once and I've got number three. That must be the first one sold because you know they're going to keep a couple."

Since then, he has continuously updated the machine and added capacity as he needed it. Since he serves as an audio consultant for Radio Shack's line of stereo equipment, he is kept informed of the new developments for the TRS-80.

Unlike many home computer users, Nero didn't play games to help him get used to the computer. The only time he recalls even using the game packages that came with the unit was to amuse two teenagers who came to his house with their father.

"I really stayed away from the games. I was only interested in it to do some work for me. If I want to play games I've got a couple computerized chess games and another one that hooks up to the TV," the musician said.

During the first year he had his TRS-80, he used it mainly as a calendar, keeping track of when he had to play, when plane flights left and also listing persons he had to contact. But while he was on tour, he started thinking of uses for the computer. Now when he isn't on the road, he works out some of the bugs and adds things that become necessary. Working with the computer during part of 1978 has helped him become proficient in the languages of computers.

Nero's TRS-80 sits on a cluttered table in the crowded home office he has converted from a bedroom. The sliding doors from the closet have been removed to provide a little extra space for someone to squeeze through. The terminal and cable sit on a lazy susan which turns so either he can use it as he sits at his desk or his wife can run the computer as she sits at a table perpendicular to his desk.

Around the desk, as in every room of his house and studio, are digital clocks. Another common appliance is the television. A small portable sits on his desk, while large models sit on the huge grand pianos that fill his living room and studio.

The TVs on the piano serve an important purpose. After tinkling the ivories for so many years, Nero has gotten to the point that he can tell whether he has hit the right note simply by the feel. He has also gotten to the point that daily practice gets quite boring. So when he sits down to practice, he simply flips the television on to something that doesn't require much attention, plugs in some headphones and lets his fingers go to work.

"I suppose I'll get in trouble for telling you this," he says. "They ran a picture of me watching TV like this once and I got some calls from music teachers who didn't think it was right because their students wanted to practice that way."

Another instrument not only follows Nero around his home and studio, but keeps in touch with him while he is touring. When he leaves his beachfront home in the Los Angeles area, Nero picks up a small telephone unit that enables him to answer any calls that come in or to phone anyone if he thinks of them while walking somewhere or sitting in his studio.

When he knows where he will be staying while he's on tour, he hooks up a telephone transfer unit and all calls to his home phone are transferred to the hotel where he is staying. This is quite handy when someone like his manager calls, but causes some problems when a friend who doesn't know about the system calls Nero's home.

"I always tell them at the hotel that if anyone calls three times in a row and hangs up, it's for me. Most of the people who call me know what is going on, but some people don't know what is going on when they call my number and get some hotel in Iowa or Chicago," he says, smiling.

This telephone unit isn't the only thing keeping him in touch with his California home. By carrying a modem and terminal with him, he can enter information into his TRS-80 or find any needed information that is stored in it. He plans to phone home after each concert and enter information such as any problems, special notes about the concert hall and to list the songs played. By keeping track of this, he can hopefully avoid the same problems when he returns on his next tour. By retaining a list of which songs went over well and which ones didn't, Nero can easily decide what type of songs go well in a given city and avoid repeating too many of the songs he played the time before.

Despite his interest in computers and their applications in his business as a musician, Nero has little interest in creating synthesized music. He has listened to several musicians who used synthesizers and used them himself, but wasn't excited with the results.

"I had the first Moog synthesizer that ever came out. It had the polyphonic keyboard mounted on a piece of plywood," he recalls. Although he toyed with the now-popular synthesizer, he soon tired of it and returned to his Steinway piano.

"When you've been trained to use the piano, you see that its potential for making music hasn't even been touched. I

ENGAGEMENT INFORMATION

DATE CONTRACT SIGNED	02/23/78
DATE OF ENGAGEMENT	03/05/79
TYPE	5. SYMPHONY
CITY & STATE	CHICAGO, ILL.
NAME OF VENUE	ORCH. HALL
HOURS	8-10PM
TERMS	10000
INSTRUMENTATION	NO HARP
PROGRAM	GERSHW
CONDUCTOR	PN
MUSIC SENT AHEAD	N
SCORES, PARTS	
SET-UP TIME	11AM
BUYER NAME	JOHN MARNEY
ADDRESS	234 WACKER DR
CONTACT	ED ROER
BUSINESS PHONE	312 435 6857
HOME PHONE	312 398 4758
ALTERNATE CONTACT	ROY GERBER
BUSINESS PHONE	213 550 0100
HOME PHONE	213 556 0230

Figure 1. Nero's Engagement Program keeps tabs on dates, programs and business contacts.

SALARY INFORMATION

DATE CONTRACT SIGNED	02/23/78
DATE OF ENGAGEMENT	03/05/79
TYPE	5. SYMPHONY
CITY & STATE	CHICAGO, ILL.
NAME OF VENUE	ORCH. HALL
HOURS	8-10PM
TERMS	10000

SALARY INFORMATION

NAME: SMITH	GROSS: $500.00
NAME: JONES	GROSS: $500.00
LIBRARIAN:	$0.00
CALL AHEAD:	$0.00
PER DIEM:	25+ 03/05/
SET-UP:	$20.00
MISCELLANEOUS	$35.00
OTHER:	$0.00

Figure 2. The Salary section will be sent to his accountants.

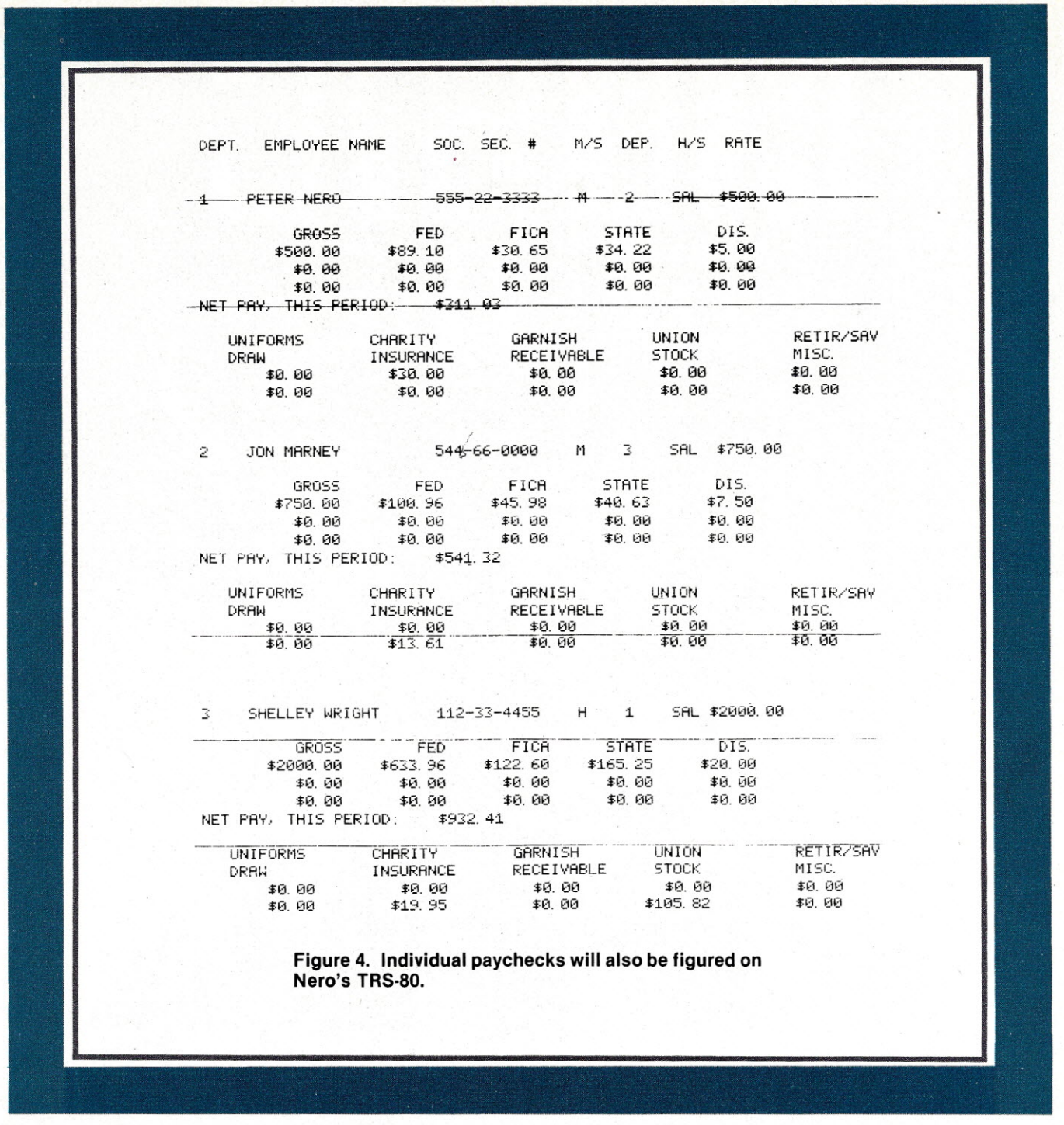
ITINERARY INFORMATION

ITINERARY FOR: NERO

DAY	FROM	TO	LEAVE	ARR	FLIGHT	CLASS	EQUIP	MEALS	STOP
03-02-79									
FRI	LAX	ORD	5PM	11:03P	UA74	F	D10	D	0

RECOMMENDED HOTEL:	HILTON
TYPE OF RESERVATION:	2 AD
LENGTH OF STAY:	4
DATE OF ARRIVAL:	03-02-79
DATE OF DEPARTURE:	03-6-79

Figure 3. Itinerary will be given to each member of the traveling party.



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DEPT.   EMPLOYEE NAME      SOC. SEC. #     M/S  DEP.   H/S  RATE

1    PETER NERO          555-22-3333      M    2     SAL  $500.00

          GROSS        FED        FICA       STATE       DIS.
        $500.00      $89.10     $30.65     $34.22      $5.00
          $0.00       $0.00      $0.00      $0.00      $0.00
          $0.00       $0.00      $0.00      $0.00      $0.00
NET PAY, THIS PERIOD:     $311.03

    UNIFORMS        CHARITY         GARNISH          UNION          RETIR/SAV
    DRAW            INSURANCE       RECEIVABLE       STOCK          MISC.
        $0.00         $30.00          $0.00          $0.00          $0.00
        $0.00          $0.00          $0.00          $0.00          $0.00


2    JON MARNEY          544-66-0000      M    3     SAL  $750.00

          GROSS        FED        FICA       STATE       DIS.
        $750.00     $100.96     $45.98     $40.63      $7.50
          $0.00       $0.00      $0.00      $0.00      $0.00
          $0.00       $0.00      $0.00      $0.00      $0.00
NET PAY, THIS PERIOD:     $541.32

    UNIFORMS        CHARITY         GARNISH          UNION          RETIR/SAV
    DRAW            INSURANCE       RECEIVABLE       STOCK          MISC.
        $0.00          $0.00          $0.00          $0.00          $0.00
        $0.00         $13.61          $0.00          $0.00          $0.00


3    SHELLEY WRIGHT      112-33-4455      H    1     SAL $2000.00

          GROSS        FED        FICA       STATE       DIS.
      $2000.00     $633.96    $122.60    $165.25     $20.00
          $0.00       $0.00      $0.00      $0.00      $0.00
          $0.00       $0.00      $0.00      $0.00      $0.00
NET PAY, THIS PERIOD:     $932.41

    UNIFORMS        CHARITY         GARNISH          UNION          RETIR/SAV
    DRAW            INSURANCE       RECEIVABLE       STOCK          MISC.
        $0.00          $0.00          $0.00          $0.00          $0.00
        $0.00         $19.95          $0.00        $105.82          $0.00
```

Figure 4. Individual paychecks will also be figured on Nero's TRS-80.

can sustain an audience for two hours with just the piano and two backup musicians. Why should I use a synthesizer?

"I've seen the guys on stage with eight keyboards surrounding them. You can't even hear them over the other instruments and the vocals. And when you can hear the guy, he doesn't really do anything creative. But I think anyone who wants to play them should go ahead. Some people are getting pretty good at putting some warmth into the music with synthesizers," he said.

Nero does use computerized sound in his home studio, however. With a variety of recording devices and sound on sound recorders which he wired together himself, he creates demo records of high quality. When recording them, he works alone, using bass and drum simulators programmed to a certain beat to back up his piano.

He has also thought of getting the computer to print the notes of his compositions onto paper so he would not have to sit at his drafting table and do the tedious chore himself.

One of the uses he has planned for his TRS-80 is to make projections that would tell him whether it would be profitable to take on an additional show during the middle of a tour.

Once he gets his current program fully operational, Nero plans to use the computer to help him decide whether it would be advisable to take the new concert. Information the computer would supply for Nero's decision would not only include financial considerations, but factors like mandatory rehearsal times, and other intangibles about each city's concert capabilities.

But for now, he is just happy to have something that will take care of some of his problems and keep everything stored in one place.

"I want to use this instead of having a secretary do it because it will be in one central place. That's what I like about it. You enter the information once and that's it," he says. "If this thing works the way we've got it set up, it will free me to get back to writing."□

MUSIC OF THE FUTURE

By Dick Moberg

The year: 1984. You're in a music store. You look around. . .no records. . .no cassettes. . .no tapes. . . no turntables. Along the walls are racks of integrated circuits and on the counters are machines with blinking lights. Hmmm. You begin to think you walked into a computer store by mistake. You walk out to check the sign. Yes, it's a music store.

THE MUSIC MEDIUM OF THE FUTURE

The music medium of the future is here now in its infancy and just waiting to explode into an industry that will wipe out the record and tape scene as it is known today. In the future, music will probably be digitally encoded as binary numbers on high density Read-Only-Memories (ROMs) to be "reconstituted" on computerized home entertainment-education-communications consoles.

The advantages of such digital recordings are in their continued quality, their flexibility when played and cost. The sound quality of records and tapes deteriorates, however slightly, with each playing due to contact between the record or tape and the stylus or tape head. But if the music is stored digitally in a ROM which is plugged into a computer, it can be "played" millions of times with no decrease in quality. Costwise these tiny integrated circuits cannot yet compare in price with producing records. But as records and tapes are going up in price along with most everything else, memories are getting more dense and cheaper every day.

A little soul or rock in the morning to get you hopping on your way . . .

How big will these ROMs have to be? As a rough estimate, consider the highest frequency to be reproduced as 20KHz which means our digitizing rate should be 40KHz. A record or a C-60 cassette contains about an hour of recording. So 60 minutes times 40,000 samples per second gives 144 million samples for an hour of music. And with a sample word size of 5 bits, this gives 720 million bits for an hour of music. Our sampling rate could easily be reduced to decrease the size of the ROM but even so it would still be large by today's standards. However, the day will come when it is as cost effective to make a ROM as it is to stamp a record. Before that day arrives, though, the other advantages of "ROM MUSIC" will far outweigh the small increase in price.

Perhaps the biggest advantage of ROM MUSIC is in the flexibility of the playback through the computer. On most conventional stereos you can alter the bass and treble when playing a record or tape and that's about it. With a computer "playing" your music the opportunities for resynthesis are limitless. You like bass? Fine. . .have the computer play the whole tune on a tuba!

Also, computers are excellent at scheduling. With several ROMs plugged in, the computer could select and play a few or all selections in any order and could turn itself on or off whenever it was told. There are even ideas floating around where the computer could sense your mood and play the appropriate music. A little soul or rock in the morning to get you hopping on your way, folk or classical during the day, and perhaps something mellow in the evening when it senses you're tired.

COMPUTER COMPOSITION

Presently, to compose music one must know the fundamentals of music theory, be proficient with an instrument, and have a certain amount of creativity. But creativity is found in the strangest places and not only in musicians. Moving from piano keyboards to ASCII keyboards and to the richer, more complex and variable sounds of the computer, music in the future will not be limited to that of the more traditionally trained musicians. New "armchair composers" will creep out and many will probably surprise us with their new-found talents.

Even the traditional composers will marvel at the flexibility of computer sounds. Instead of using many different instruments to produce a finite range of sounds, the musician now has one instrument that can produce an infinite array of sounds. Yet it can synthesize perfectly the sounds of the traditional instruments (for those who doubt this I suggest listening to some of the new recordings of computer music).

One of the early computer music pioneers, Hal Chamberlin, developed a technique where anyone can play a sound of his favorite instrument into a computer. It will analyze the frequency content of a short segment of the sound and use this computed fundamental waveform (instead of just a sinewave, for example) to resynthesize the instrument's sound perfectly for use in an individual's compositions. However, your instrument now has a range from tuba to piccolo! The technique is so good that one can even tell the difference between the same instrument played in rooms with different acoustical properties. It is also possible to make up your own waveform and thus make up your own instrument or combination of instruments (a "piccophone", an "obonet"?).

Hooking the computer up to some more hardware gives it even more flexibility. There are single integrated circuits available called complex sound generators (Texas Instruments' SN76477, for example) that can synthesize anything from a bird chirp to a racing car motor to a cannon blast. These integrated circuits are being used in many of the newer commercial video games.

But why not let a computer control them? How many times have we heard the 1812 Overture with bass drum instead of the specified cannons? Now this chip can synthesize the cannons while the computer plays the overture. Wouldn't it be nice to hear a piece from the Romantic Period with real sounding birds chirping instead of a flute? And further, with near perfect speech synthesis circuits around now (as found in the new children's game Speak and Spell) it should soon easily be able to synthesize accompaniments for synthesized singing voices!

MUSIC FOR THE PEOPLE

Some people probably think computers are now going to totally foul up everything from the first Gregorian chant on up to the Beatles. Instead, computers will bring music — making music — to the people!

A professional musician spends most of his life learning how to play one, or a few, instruments very well. Constant painful practice is the keyword for success for even the most talented. But what about those among us who don't have a lifetime to spend on music alone, or who are not quite coordinated enough to run their fingers across a piano keyboard and produce anything other than noise, or worse, those unable to use their fingers? Should these people be deprived of composing, playing and enjoying their own music? Of course not. The computer is their answer. Radio and TV brought music listening to the people and now computers will bring the capability of music composition to them. □

SPECTRAL MUSIC

By G.S. Stiles

INTRODUCTION

Music may be studied for several reasons. The simple enjoyment of becoming acquainted with the various forms of musical expression that have developed through the ages is justification enough. Those with a theoretical interest may enjoy a detailed examination to discover one or more features that are characteristic of "good" as opposed to "bad" music. The discovery of such characteristics, if they exist, would be most rewarding. If the characteristics are particularly well defined, they may be used as constraints in the generation of music by digital computers.

This technique is suitable for implementation on microcomputers. Readily usable for both the analysis of existing music and the creation of new music, it is based upon the analysis of the "spectrum" of the sequence of notes that make up a melody. The sequence of notes can be represented as a sequence of numbers, each note corresponding to a unique number. This numeric sequence can be transformed by a computer into a second sequence called the spectrum of the melody. The spectrum, in essence, tells how the initial melody is composed of simpler melodies.

The notes of the simpler melodies vary in a definite manner (sinusoidally) and at a definite rate (or frequency). The numbers of the spectrum represent the relative amplitudes of the different simple melodies that have to be combined to produce the initial melody.

The important point is that the spectra of "good" music tend to have a characteristic shape: The squares of the relative amplitudes of the simple components tend to decrease in proportion to the frequency of the components. Thus, if the square of the amplitude of the lowest frequence component is 1, the square of the amplitude of the component at twice the lowest frequency would be ½. In general, the square of the amplitude of the component at "n" times the lowest frequency would be 1/n.

The analysis and synthesis of music discussed are based upon the calculation of the spectra of the melodies. New melodies may be created in two ways. First, one may calculate the spectrum of a known tune and then modify in some manner the amplitude and/or the phase. The modified spectrum may then be transformed back into a new melody (an operation that can also be carried out by a computer).

Second, an entirely new tune may be created by specifying, in some manner, the amplitude and phase of a spectra and then transforming it into a tune.

SPECTRAL ANALYSIS

Spectral analysis is, in a sense, the study of how complex variations are composed of more simple variations. Examples of quantities that show "complex" variations with time are shown in Figure 1. The daily variation of outside temperature, shown in Figure 1a, is fairly regular and not too complex. The plot of the closing stock market prices, in Figure 1b, is considerably more complex but still shows some signs of regularity. The third curve, Figure 1c, represents the output of a light that is either entirely on or entirely off. The curve does not show a smooth variation, as do

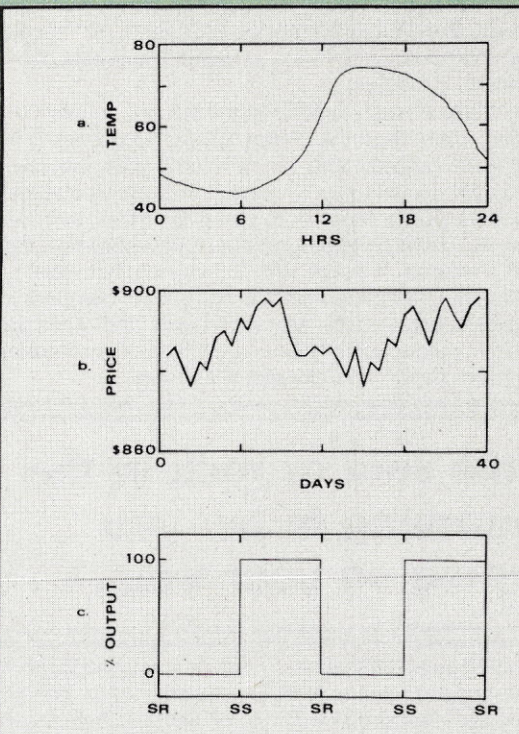


Figure 1. Examples of quantities that vary with time:
a. Variation of temperature at one location over 24 hours.
b. Daily stock market closing over a 40 day period.
c. Percentage output of a light that is switched on at sunset (SS) and off at sunrise (SR).

Figures 1a and 1b, but jumps abruptly between two values. Such curves, usually referred to as square waves, are common in digital circuitry and, at first glance, bear little resemblance to the smoother curves of Figures 1a and 1b.

Another type of variation is shown in Figure 2. Figure 2a is a plot of one cycle of the voltage measured across a 120 volt AC power line, such as found in the home. (Note that the *peak* voltages reached by the power line are about ±170 volts; 120 volts is the average of the square of the voltage over one cycle.) The variation shown by the AC voltage is well defined and is referred to as a *sinusoidal* variation.

The rate at which the voltage varies is specified by its frequency; the household AC line goes through a complete cycle 60 times a second and hence has a frequency of 60 cycles per second, or 60 Hertz. Figure 2b shows a signal with a frequency of 120 Hertz. (Note that while the time axis of Figure 2b is the same as that of 2a, the *angle* axis has been diminished so that 360 degrees corresponds to one cycle; thus any sinusoidal signal is said to go through a full 360 degrees for each complete cycle, regardless of its frequency.)

Several methods are used to specify the amplitude of a sine

wave. Engineers concerned with power, as noted above, may refer to the average of the square of the signal. One may also specify the peak-to-peak voltage, i.e., the difference between the positive and negative peaks. (The 120 volt AC line has a peak-to-peak amplitude of about 340 volts.) A third method specifies the peak positive amplitude of the sine wave; thus, when the term 1 volt sine wave is used, it refers to a signal that varies sinusoidally between +1 volt and −1 volt.

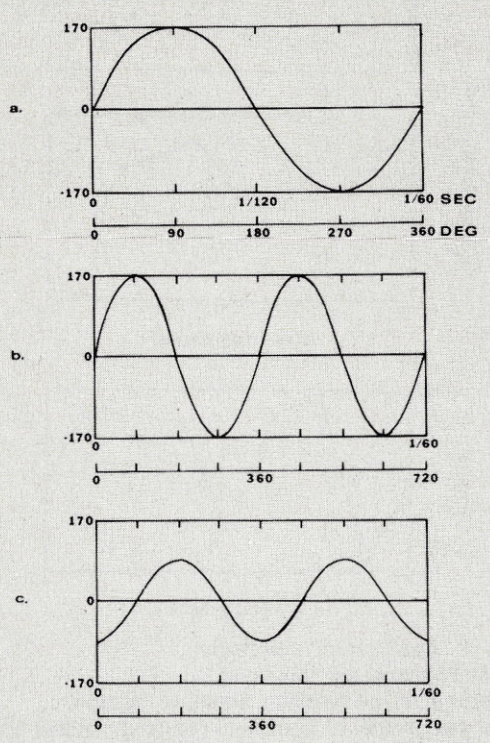


Figure 2. Examples of sinusoidal variations (sine waves):

a. One cycle of the 60 Hertz, 120 volt household service.

b. Two cycles of a 120 Hertz, 120 volt service; note that the time scale does not change but the angular scale does.

c. Two cycles of a 120 Hertz, 60 volt service, which lags the signal of 2b by ¼ cycle, or 90 degrees.

Once the frequency and amplitude of a sine wave are specified, its size and shape are completely determined. The one remaining variable is the position of the wave relative to other signals; the relative position is referred to as the phase. The phase of one signal, relative to a reference signal, is the difference, measured in degrees, between the times when the two signals pass through the same point. Thus the phase of the signal in Figure 2c, relative the two signals pass through the same point. Thus the phase of the signal in Figure 2c, relative to the signal in Figure 2b, is −90 degrees: the signal in Figure 2c passes through any given point, such as the positive maximum, 90 degrees (or ¼ of a cycle) after the signal in Figure 2b. On the other hand, if we choose Figure 2c as the reference, the phase of Figure 2b, relative to Figure 2c, is +90 degrees.

In order to have a consistent definition of phase, assume that the phase of a signal of a given frequency is to be measured relative to an imaginary reference signal of the *same* frequency that is passing through zero amplitude and increasing at a time t = 0 (i.e., a signal like that of Figure 2a or 2b). Since time is the same for all signals, regardless of frequency, this assumption allows signals of different frequencies to be aligned.

Sine waves are graceful, but their very regularity would seem to make them of limited use in the study of greatly differing melodies. Their utility lies in the fact, discovered decades ago by the French scientist Fourier, that *any* naturally occurring variation, regardless of shape, can be made up from a sum of sinusoidal variations.

Fourier's discovery may at first appear highly improbable, but it is not surprising to learn that the curve of Figure 1a could be suitably well approximated by a sum of sine curves. It is difficult, at first, to see how the sharp-cornered square-wave of Figure 1c can be obtained by adding up smooth sine waves. Figure 3 shows that such a trick is possible.

The square wave to be approximated is at the bottom of the figure. At the top is a sine wave of the same frequency but slightly greater amplitude. The second panel shows a sine wave of three times the frequency of the first and decreased amplitude. The third panel shows the sum of the first two sine waves. Note that the sum already looks more like a square wave than a simple sine wave. The fifth panel shows the result of adding the curve of the fourth panel; again the approximation improves.

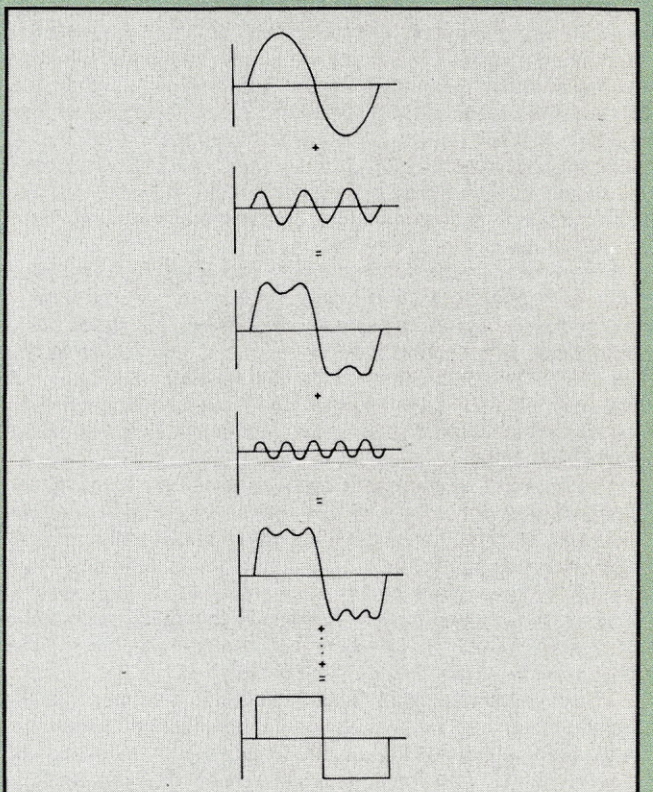


Figure 3. Creation of a square wave (bottom) by the addition of a series of sine waves. Only sine waves which have an odd number of complete cycles in one cycle of the square wave are included.

As more and more terms are added, the approximation will continue to improve: the edges all become steeper and the ripples become smaller and smaller. One may approach as closely as desired to a true square wave by simply adding more terms.

FOURIER'S TRANSFORMATION

To summarize, Fourier discovered that any reasonable curve can be accurately represented by a summation of sine curves of appropriate frequency, amplitude, and phase. Fourier also provided a method for finding just which sine curves are required to represent any given signal. This method, called Fourier analysis or spectral analysis, gives the amplitude and phase for each frequency component.

The distribution of amplitude and phase versus frequency is called the *spectrum* of the given signal. The operation that

obtains the spectrum from the signal is referred to as a Fourier transformation. The Fourier transformation of a signal yields the signal's spectrum; the spectrum tells us the amplitudes and phases of the sine waves that, when summed, will reproduce that signal.

Up to this point we have been dealing primarily with continuous signals. In the digital world we are limited to dealing with finite sets of numbers, and must therefore work only with *discrete* signals — i.e., signals that are represented by sequences of numbers. Fortunately discrete versions of the Fourier transformation also exist and allow us to compute the spectra of discrete curves. (Representation of a melody by a series of notes is a discrete curve.) The computer implementation of the discrete Fourier transform is discussed in the Appendix.

The discrete Fourier transform yields a spectrum that specifies the amplitude and phase at a certain set of frequencies. The lowest frequency is zero, or d.c.; the amplitude of the d.c. component of the spectrum is actually the average value of the initial signal. The first non-zero frequency is equal to the reciprocal of the duration, in time, of the initial signal. The next component is at twice the lowest frequency, the next at three times, and so on. The last component is at a frequency equal to N/2 times the lowest frequency, where N is the number of points in the discrete signal that was transformed to obtain the spectrum. Thus, if one transforms a signal that is ½ second long and is composed of 8 points, spectral components at 0, 1/½ = 2, 4, 6, and 8 Hertz will be obtained. At each frequency the spectrum consists of two numbers, one representing the amplitude of the component at that frequency and one the phase.

It has been noted that pleasant melodies typically have what is known as a "1/f" power spectrum; thus doubling the frequency halves the power. In general, if a power spectrum decreases proportional to $1/f^n$, n is referred to as the spectral index. Most spectra do not behave exactly in this manner, but an "average" spectral index can be calculated for any spectrum and does serve as a useful indicator of the overall behavior.

The method of analysis described thus far serves as the basis of the remainder of this article. A melody may be analyzed by first converting its notes into a sequence of numbers; this sequence is then Fourier transformed. From the resulting spectrum one may calculate an average spectral index, and the amplitude and phase of the spectrum may be compared to the spectra of other melodies to search for characteristic similarities or differences.

The reverse operation is also possible: one may initially specify the amplitude and phase of a spectrum and then, using a reverse Fourier transform, obtain a new melody. (The reverse Fourier transform, also discussed in the Appendix, is nearly identical to the Fourier transform.)

ANALYSIS

The analysis phase is simply the study of existing melodies. The notes are first converted into a sequence of numbers which is transformed to obtain the amplitude and phase spectra.

An example of this with a familiar tune is shown in Figure 4. Figure 4a, at top, shows in conventional musical notation the first sixteen (16) notes of the folk song "Michael, Row the Boat Ashore" (the choice of 16 notes, not a necessity, is explained in the Appendix). This melody is converted into a sequence of numbers according to the scheme in Figure 4b. The resulting sequence is plotted in Figure 4c. (This simple scheme of translating notes into numbers is not the only one possible. Experimenting with different methods and scales other than the chromatic should prove interesting.)

The sequence of numbers is transformed, yielding the amplitude spectrum shown in Figure 4d and the phase spectrum in Figure 4e. The amplitude is plotted on a log-log scale simply because if the spectrum follows a true power-law, it will appear as a straight line. Note that the d.c. (zero

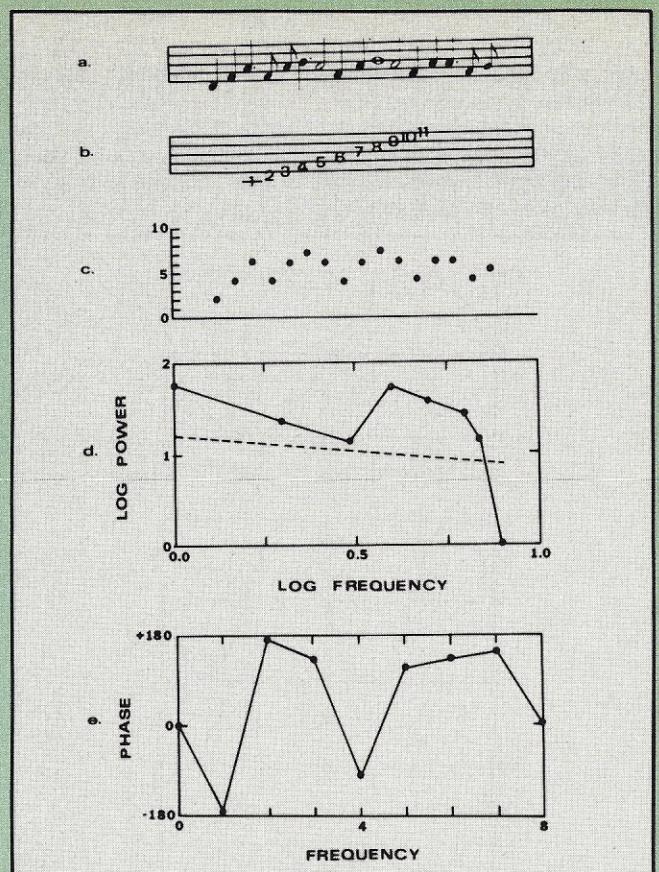


Figure 4. Analysis of a melody:
a. First 16 notes of "Michael".
b. Scheme for converting notes to numbers.
c. The sequence of numbers corresponding to the melody in 4a.
d. Solid line: power spectrum of the sequence in 4c; dashed line: best-fit power law spectrum with an index of 0.34.
e. Phase spectrum of the sequence in 4c.

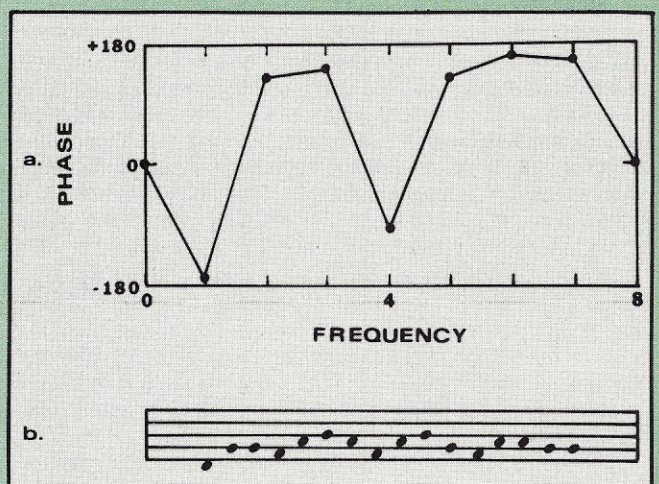


Figure 5. Modification of an existing melody to produce a new melody:
a. Phase spectrum of 4e modified by a random perturbation of each internal point by a quantity in the range of ±45 degrees.
b. Melody obtained by reverse-transforming the power spectrum of 4d and the phase spectrum of 5a.

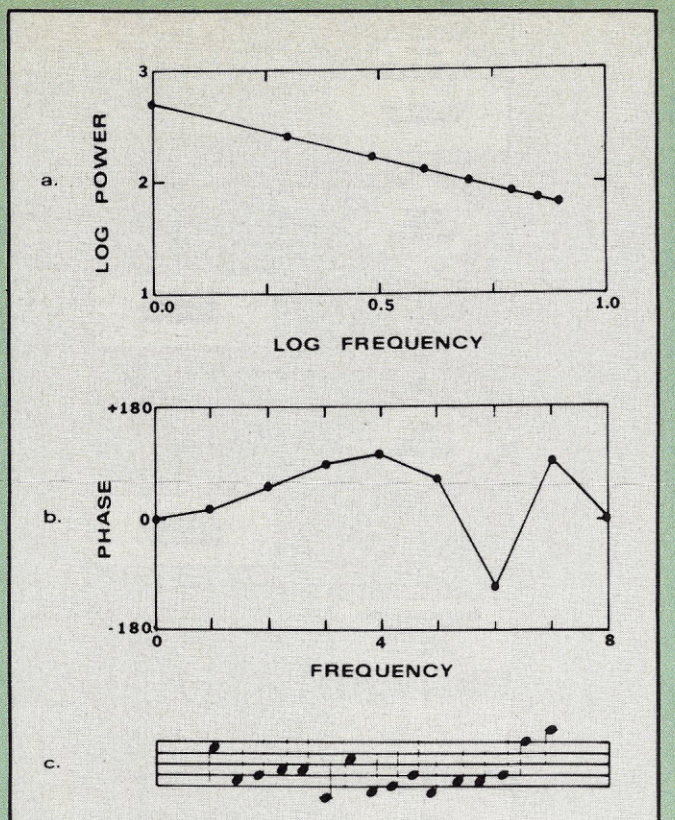


Figure 6. Synthesis of a new melody:
a. Specified 1/f power spectrum.
b. Phase spectrum generated from a sequence of random numbers in the range ± 180 degrees.
c. Melody obtained by reverse-transforming the spectra of 6a and b.

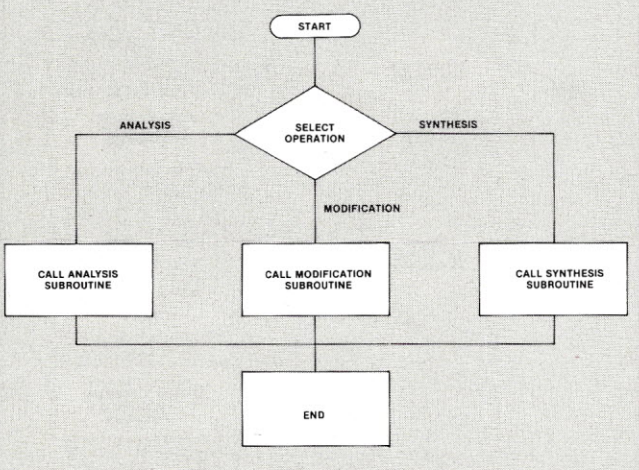


Figure 7. Flowchart of main program.

frequency) component is not plotted, since it represents only the average of the initial sequence.

The amplitude spectrum is fairly irregular and is obviously not a true power law spectrum, although it does tend to decrease with increasing frequency. The straight dashed line represents a power law with an index of 0.34 and is the best, on the average, power law approximation to the true spectrum. (The method of calculating the index of the "best fit" power law is given in the Appendix.)

We should not be surprised that the spectrum of Figure 4d is not a true power law with an index of 1.0 (i.e., a "1/f" spectrum). Averaging the spectra of many melodies, or averaging many spectra from one song is an experiment that can easily be carried out on a small computer.

The phase is plotted in Figure 4e on a linear scale from −180 to +180 degrees; the frequency scale is also linear. The phase shows large variations and no clear trend is noticeable. This result is typical of the relatively few melodies I have examined, but more extensive studies may reveal repeatable features.

The main purpose of analysis is to obtain spectra for comparison and as guides to the creation of new tunes. It should be interesting to compare types of music or different composers.

CREATION THROUGH MODIFICATION

Analysis also serves as the basis of the "creation" of new melodies through the modification of existing melodies. The technique is simply to transform the existing melody, then modify the amplitude and/or the phase, and finally to reverse transform the modified spectrum into a "new" melody.

An example of the modification of "Michael" is shown in Figure 5. In this case I chose not to modify the amplitude spectrum, leaving the melody as it appears in Figure 4d. The phase (Figure 4e) was modified by adding to each angle a random number between −45 and +45 degrees. The modified phase is shown in Figure 5a.

The melody resulting from transforming the modified spectrum is shown in Figure 5b. The tune is not unpleasant and bears a certain resemblance to the original.

The schemes for modification of the spectrum are unlimited. The amplitudes may have added to them random numbers varying from 0 to ± 100% of the initial value; the phase may have random perturbations ranging from −180 to +180 degrees. The amplitude and/or the phase could be entirely replaced by random sequences of numbers. The amplitude could be replaced with a power law spectrum of a given index, or with a spectrum depending upon some other law; new phases could be similarly generated. These schemes can also be combined in any manner desired. For example, one could generate a true power law spectrum and subject it to a 10% random perturbation.

CREATION THROUGH SYNTHESIS

The second method of creating new melodies consists simply in choosing an amplitude and phase spectrum and using the reverse transform to produce a melody. (The methods used above may be used to generate new spectra.) Figure 6 shows the steps involved in one attempt.

The amplitude spectrum chosen is shown in Figure 6a and is a simple power law of index 1. (Setting the d.c. component, which is not plotted, to 1000 and the lowest frequency component to 500, and then calculating the remaining terms, results in a melody that has reasonable numbers — i.e., on the order of 1 to 10.) The phase spectrum (Figure 6b) consists of a sequence of random numbers between −180 and +180 degrees.

The melody obtained by applying the reverse transform to this spectrum is shown in Figure 6c. The tune is not unpleasant when played on a piano.

The synthesis field, like that of modification, is obviously wide open and limited only by a person's imagination. A proper combination of inspiration and guidance obtained from the analysis of known good works could produce a masterpiece.

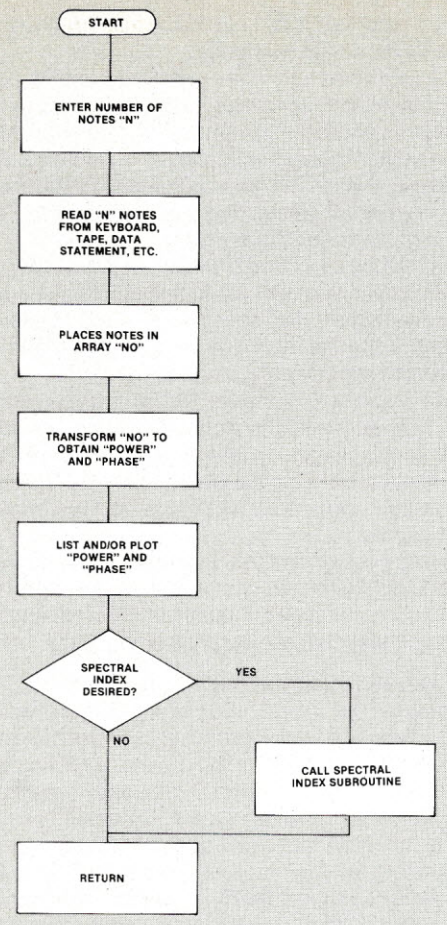


Figure 8. Flowchart of analysis subroutine.

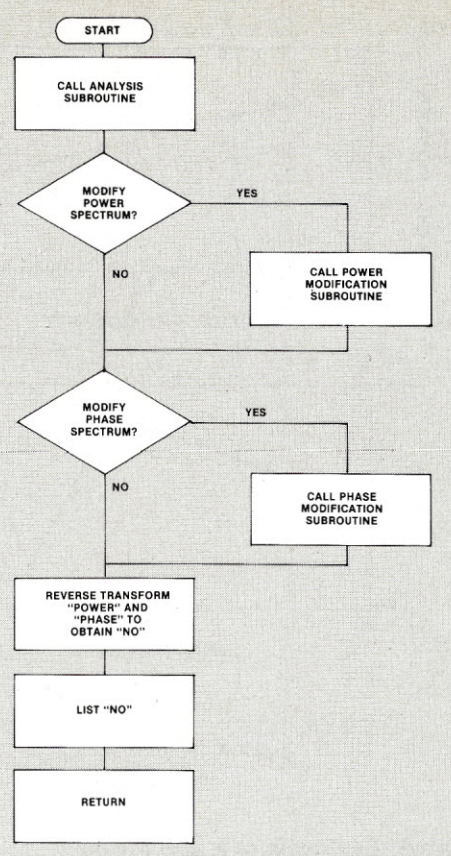


Figure 9. Flowchart of modification subroutine.

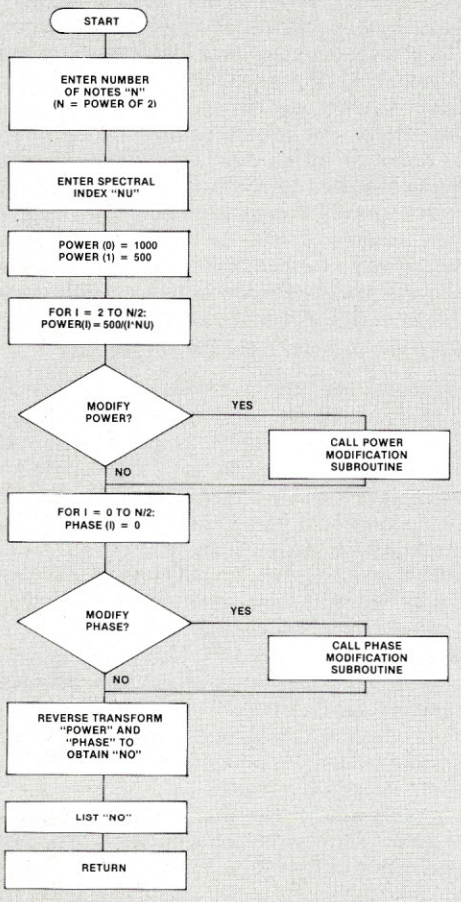


Figure 10. Flowchart of synthesis subroutine.

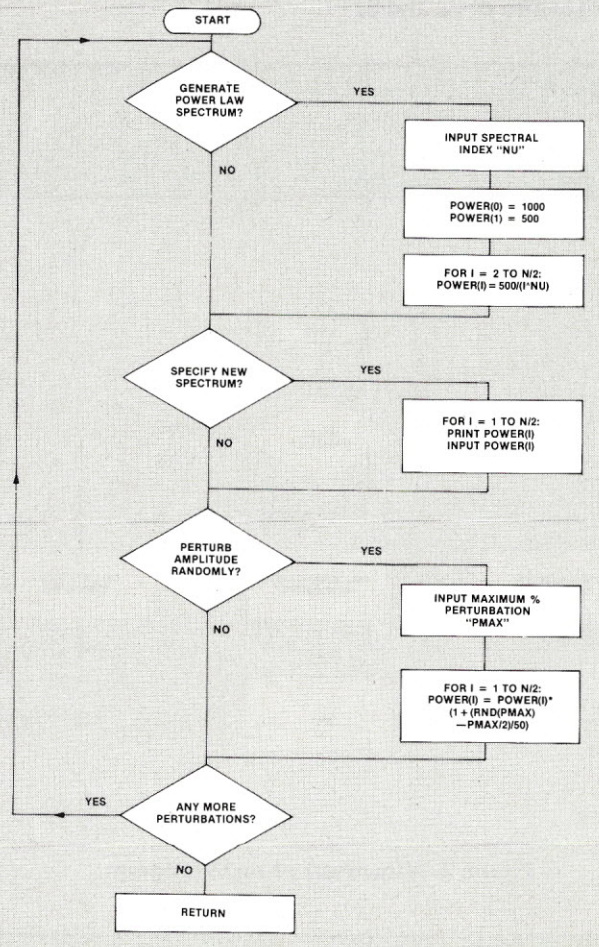


Figure 11. Flowchart of power modification subroutine.

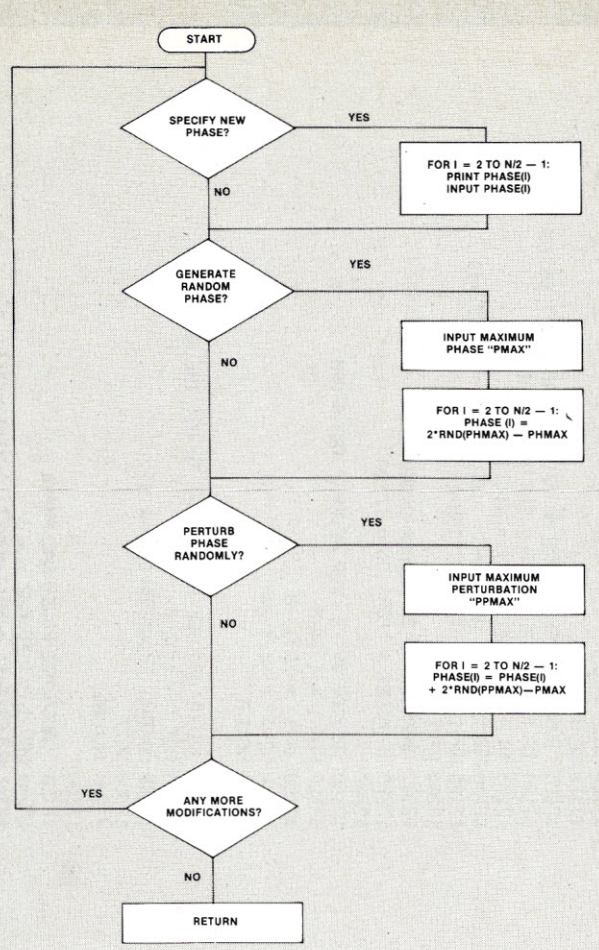


Figure 12. Flowchart of phase modification subroutine.

CONCLUSION

So far the rhythm, or the relative durations of the notes, has been ignored. I have not considered whether a given note was a quarter-note, half-note, etc. Some results also apply to the spectra obtained from the transformation of sequences created by assigning numbers to the *duration* of each note. An eighth-note could be represented by 1, a quarter-note by 2, and so on. This observation provides a method for creating a new melody with rhythm: two spectra are created; one is transformed to obtain the pitch and one the duration of each note.

The spectral analysis and creation of music combines two fields which both provide enjoyment as well as great theoretical and practical interest. As is often the case in computing, its boundaries are formed only by the limits of the programmer's imagination.□

APPENDIX

Rather than provide a complete listing of the program, which runs over 12,000 bytes and is tailored to my own system, a gross flow chart of the programs and listings only of the two most mathematical routines are provided. This approach should permit users to create programs more suited to their desires.

The main program (Figure 7) simply prompts the user to enter the operation he would like to perform. The appropriate subroutine is then called.

The flow of the subroutines may be followed by referring to the appropriate section of this article, but a few additional points should be noted. The subroutines to modify the power and phase are set up so the user may do as many successive modifications as desired. The spectral values may be examined at any time in the modification cycle by asking to specify a new spectrum and the re-entering of the value that is printed out for each component.

The d.c. power component (POWER(0)) is not modified. When a new power spectrum is generated, POWER(0) is set to 1000 and POWER(1) is set to 500; the remaining components are calculated from POWER(1) and the specified spectral index. The phases at the lowest (PHASE(0)) must always be zero and that at highest frequencies (PHASE(N/2)) must always be zero or 180 degrees.

The Fourier transform routine is shown in Listing 1. The initialization portion sets up the sine and cosine factors and need only be called once if the number of points to be transformed does not change. The transform itself will operate in either a forward or reverse direction, depending upon the value of MODE$; note that the difference between the two directions is only in the sign of M1 and the normalization procedure at the end of the routine.

The particular version of the Fast Fourier Transform used requires the input array to have a dimension equal to an integral power of 2. If this is not the case, the routine adds enough zeros to the front and back of the array to make the total number of points equal to a power of 2.

An adequate explanation of the complex mathematics involved in the Fourier transform and the rather clever tricks in the Fast Fourier Transform would require another lengthy article. Details may be found in any modern text on digital signal processing (i.e., *Digital Signal Processing,* by Oppenheim and Schafer, Prentice Hall, 1975).

Table 1.

ARRAY INDEX	NO.	ARRAY POWER	PHASE
0	2	6889.0	0
1	4	59.0926	-173.971
2	6	22.1716	178.524
3	4	12.9886	132.338
4	6	53.0	-105.945
5	7	37.6979	116.549
6	6	27.8285	128.625
7	4	14.2211	147.593
8	6	1.0	0
9	7		
10	6		
11	4		
12	6		
13	6		
14	4		
15	5		

The routine to calculate the best fit spectral index is reproduced in Listing 2. The routine creates two arrays, one containing the log of the frequency and one the log of the power. The routine then calculates the linear mean-square regression coefficient of the log of the power on the log of the frequency. This coefficient is the best-fit spectral index, NU.

Table 1 shows the values taken on by the different variables for a sample run. The only variables input are the elements of the array NO; the remaining values are all calculated. It is useful to remember for debugging that if one reverse transforms the results of a forward transform, the output of the reverse transform *must* be identical to the input of the forward transform.

Program Follows

PROGRAM LISTING 1

```
10000 '-------- F O U R I E R    T R A N S F O R M --------
10010 '
10020 'CAUTION:  THE EXPONENIATION SYMBOL (NORMALLY AN UP-
10030 'ARROW) PRINTS AS  "["
10040 '
15000 'INITIALIZATION SECTION:  SETS UP SINE AND COSINE FACTORS.
15010 'THIS SECTION NEED ONLY BE CALLED ONCE IF THE NUMBER OF
15015 'TRANSFORMED POINTS DOES NOT CHANGE.
15020 '
15030 'THE DIMENSION OF  WR  AND  WI  MUST BE M/2,
15040 'WHERE  M  IS THE FIRST POWER OF TWO THAT IS EQUAL TO
15050 'OR GREATER THAN THE NUMBER OF ELEMENTS  N  IN THE ARRAY
15060 'NO.
15070 '
15080 TP = 3.141593*2.0 : DTR = 3.14159/180.0
15090 L2 = 0.693147
15100 '
15110 'FIND LOG BASE 2 OF FIRST POWER OF 2 EQUAL TO OR GREATER
15120 'THAN N:
15130 M = 1.0 : LM  = 0
15140 M = 2*M : LM = LM + 1 : IF M < N GOTO 15140
15150 '
15160 'CALCULATE DIMENSION OF  WR  AND  WI:
15170 WD = M/2
15180 '
15190 'CALCULATE PHASE FACTORS:
15200 FOR I = 1 TO WD
15210 ARG = (I-1)*TP/M
15220 WR(I) = COS(ARG)
15230 WI(I) = SIN(ARG)
15240 NEXT I
15250 RETURN
15260 '
15270 'END INITIALIZATION.
15500 '
15510 'TRANSFORM SECTION:
15520 'THIS ROUTINE PERFORMS EITHER A FORWARD OR REVERSE
15530 'TRANSFORM.  IF MODE$ = "FOR"  THE ARRAY  NO  IS PUT
15540 'INTO XR, THE ARRAY  XI  IS SET TO ZERO, AND A FORWARD
15550 'FAST FOURIER TRANSFORM IS PERFORMED ON  XR  AND  XI.
15560 'THE ARRAYS  POWER  AND  PHASE  ARE THEN CALCULATED FROM
15570 'XR  AND  XI.
15580 'IF MODE$ = "REV" THE ARRAYS  XR  AND  XI  ARE CALCULATED
15590 'FROM  POWER  AND  PHASE,  XR  AND  XI  ARE REVERSE
15600 'TRANSFORMED, AND  NO  IS LOADED FROM XR.
15610 'XR AND XI MUST HAVE DIMENSIONS OF  M; BIT MUST HAVE
15613 'DIMENSION  LM, WHERE LM = LOG BASE 2 OF M.
15615 '
16640 XI(I8%) = XI(I8%)*WR(I9%) + M1*T1*WI(I9%)
16650 XR(I7%) = XR(I7%) + TR : XI(I7%) = XI(I7%) + TI
16660 NEXT I6%
16670 NEXT I5%
16680 NEXT I1%
17000 '
17010 'THE FFT LEAVES THE ARRAYS WITH THE ELEMENTS INDEXED
17020 'IN A BIT REVERSED ORDER:  NEXT SECTION CORRECTS THIS.
17040 FOR I1% = 1 TO M - 1
17050 'CONVERT I1% TO BINARY, STORE BITS IN ARRAY "BIT":
17060 T% = I1%
17070 FOR I2% = 1 TO LM
17080 T1% = T%/2.0 + 0.1
17090 BIT(I2%) = T% - 2*T1%
17100 T% = T1%
17110 NEXT I2%
17120 'COMPUTE INDEX CORRESPONDING TO BITS IN REVERSE ORDER:
17130 T% = 1 : I3% = 0
17140 FOR I2% = LM  TO 1 STEP -1
17150 I3% = I3% + T%*BIT(I2%)
17160 T% = 2*T%
17170 NEXT I2%
17175 'SOME REVERSALS HAVE NO EFFECT, AND DON'T SWITCH TWICE:
17180 IF I3% = I1% OR I3% > I1% GOTO 17200
17185 TR = XR(I1%+1) : TI = XI(I1%+1)
17190 XR(I1%+1) = XR(I3%+1) : XI(I1%+1) = XI(I3%+1)
17195 XR(I3%+1) = TR : XI(I3%+1) = TI
17200 NEXT I1%
17203 'ARRAYS ARE IN PROPER ORDER NOW.
17205 IF MODE$ = "FOR" GOTO 17320
17207 '
17210 'DIVIDE BY  M  FOR REVERSE TRANSFORM:
17220 FOR I = 1 TO M
17230 XR(I) = XR(I)/M
17240 XI(I) = XI(I)/M
17250 NEXT I
17260 '
17270 'ROUND OFF THE ARRAY  XR  TO GET THE ARRAY  NO:
17280 FOR I = 1 TO M:
17290 NO(I-1) = INT(XR(I) + 0.5)
17300 NEXT
17305 RETURN
17310 '
17320 'CALCULATE POWER AND PHASE:
17330 FOR I = 1 TO M/2 + 1.1
17340 POWER(I-1) = XR(I)*XR(I) + XI(I)*XI(I)
17350 ZX = XR(I) : ZY = XI(I) : GOSUB 30000 : PHASE(I-1) = ZZ
17360 NEXT I
17370 RETURN
```

```
15620 'CALCULATE FIRST POWER OF TWO >= N:
15630 M = 1 : LM = 0
15640 M = 2*M : LM = LM + 1 : IF M < N GOTO 15640
15660 '
15670 IF MODE$ = "REV" GOTO 16000
15680 'FORWARD TRANSFORM:
15690 'FIRST CHECK TO SEE IF  NO  CONTAINS A NUMBER OF POINTS
15700 'EQUAL TO A POWER OF TWO:
15710 IF N = M GOTO 15800
15720 '
15730 'N  IS NOT EQUAL TO A POWER OF TWO; ZEROS MUST BE ADDED
15740 'TO XR TO MAKE UP THE DIFFERENCE:
15750 I1 = (M-N)/2
15760 FOR I = 1 TO I1 : XR(I) = 0.0 : NEXT I
15770 FOR I = M-I1 TO M : XR(I) = 0.0 : NEXT
15800 '
15810 'FILL  XR  WITH  NO:
15820 I1 = (M-N)/2
15830 FOR I = 1 TO N
15840 XR(I1+I) = NO(I-1)
15850 NEXT I
15860 '
15870 GOTO 16500
16000 ' REVERSE TRANSFORM:
16010 '
16020 'CALCULATE REAL AND IMAGINARY ARRAYS FROM  POWER  AND
16030 'PHASE:
16040 XR(1) = SQR(POWER(0)) : XI(1) = 0.0
16050 FOR I = 2 TO M/2+1.1
16060 R = SQR(POWER(I-1)) : C = COS(PHASE(I-1)*DTR) : S = SIN(PHASE(I-1)*DTR)
16070 XR(I) = R*C : XI(I) = R*S
16080 'CALCULATE CONJUGATES:
16090 XR(M+2-I) = XR(I) : XI(M+2-I) = -XI(I)
16100 NEXT I
16500 '
16510 'FAST FOURIER TRANSFORM:
16520 IF MODE$ = "FOR" THEN M1 = -1 ELSE M1 = 1
16530 FOR I1% = 1 TO LM
16540 I2% = 2[(LM + 1 - I1%) + 0.1
16550 I3% = I2%/2.0 + .1
16560 I4% = 2[(I1% - 1) + .1
16570 FOR I5% = 1 TO M STEP I2%
16580 FOR I6% = 1 TO I3%
16590 I7% = I5% + I6% - 1  :  I8% = I7% + I3%  :  I9% = I4%*(I6%-1) + 1
16600 TR = XR(I8%) : TI = XI(I8%)
16610 XR(I8%) = XR(I7%) - XR(I8%) : XI(I8%) = XI(I7%) - XI(I8%)
16620 T1 = XR(I8%)
16630 XR(I8%) = T1*WR(I9%) - M1*XI(I8%)*WI(I9%)
```

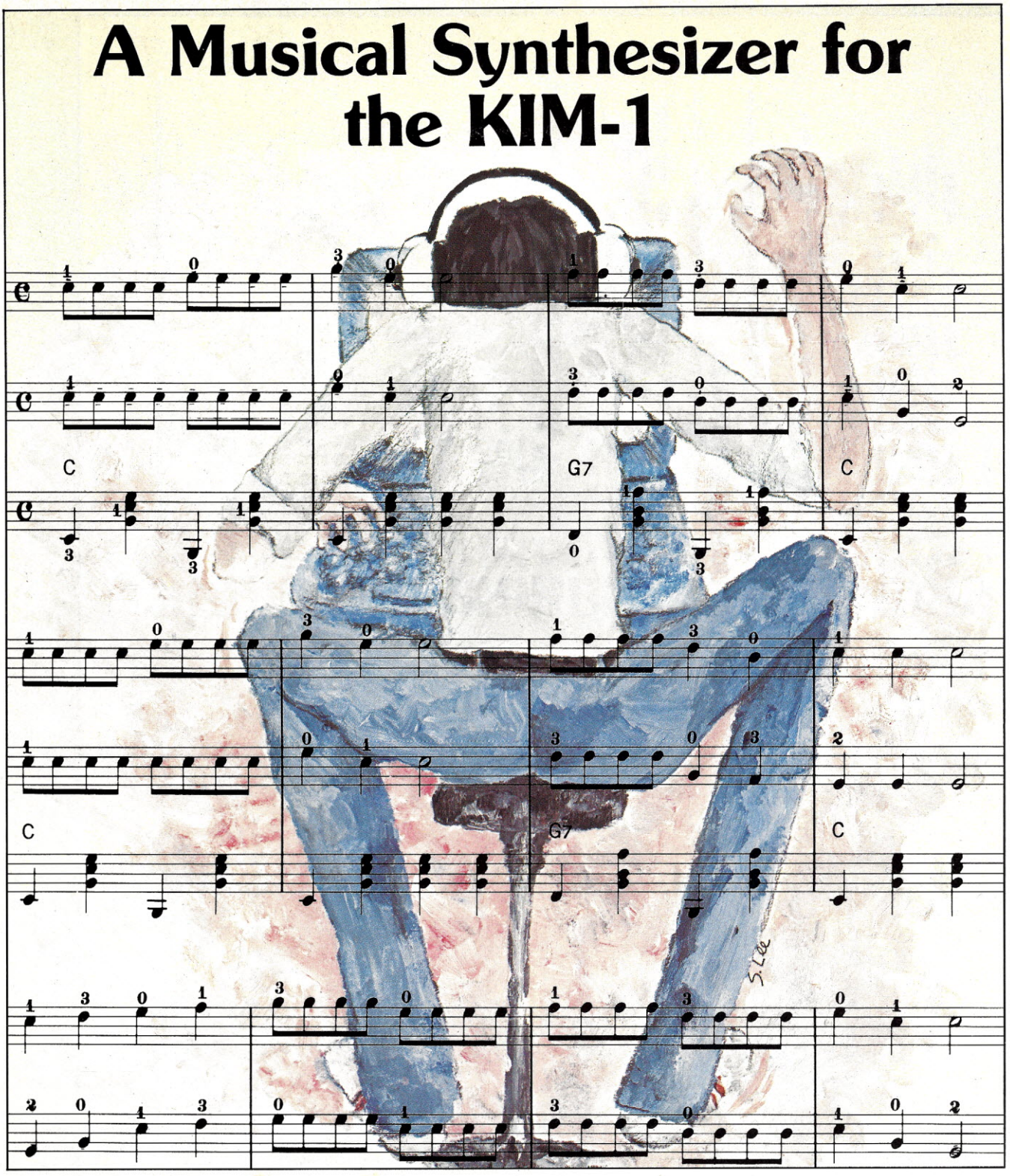


```
17380 '
30000 'TWO ARGUMENT ARC TANGENT ROUTINE:
30010 'COMPUTES  ZZ = ARC TAN (ZY/ZX) AND PUTS IT IN THE
30020 'PROPER QUADRANT.
30030 '
30040 IF ZY = 0.0 AND ZX > 0.0 THEN ZZ = 0.0 : RETURN
30050 IF ZY = 0.0 AND ZX < 0.0 THEN ZZ = 180.0 : RETURN
30060 IF ZY > 0.0 AND ZX = 0.0 THEN ZZ = 90.0 : RETURN
30070 IF ZY < 0.0 AND ZX = 0.0 THEN ZZ = -90.0 : RETURN
30075 IF ZX = 0.0 AND ZY = 0.0 THEN ZZ = 0.0 : RETURN
30080 Z1 = ZY/ZX
30090 ZZ = ATN(Z1)/DTR
30100 IF ZX >= 0.0 RETURN
30110 IF ZY >= 0.0 THEN ZZ = 180.0 + ZZ ELSE ZZ = ZZ - 180.0
30120 RETURN
30130 '
30140 '===============  END  FOURIER  TRANSFORM  ==============
```

PROGRAM LISTING 2

```
20000 '--------------  POWER CURVE FITTING ROUTINE ------------
20010 '
20020 'THIS ROUTINE FINDS THE POWER LAW INDEX  NU  THAT GIVES
20030 'THE BEST FIT OF A POWER LAW TO THE POWER SPECTRUM.
20040 'LP  AND  LF  MUST HAVE DIMENSION EQUAL TO M/2, WHERE
20050 'M  IS THE FIRST POWER OF 2 LARGER THAN  N.
20055 'N  IS THE NUMBER OF NOTES IN THE ARRAY  NO.
20060 '
20070 'CALCULATE THE ARRAYS CONTAINING THE LOG OF THE FREQUENCY
20080 'AND THE LOG OF THE POWER (SKIP D.C.  POWER TERM):
20090 FOR I = 1 TO M/2
20100 LP(I) = LOG(POWER(I))
20110 LF(I) = LOG(I)
20120 NEXT I
20130 '
20140 'INITIALIZE SUMMATION VARIABLES:
20150 S1=0.0 : S2=0.0 : S3=0.0 : S4=0.0
20160 '
20170 'CALCULATE SUMS:
20180 FOR I = 1 TO M/2
20190 S1 = S1 + LF(I)
20200 S2 = S2 + LP(I)
20210 S3 = S3 + LF(I)[2
20220 S4 = S4 + LF(I)*LP(I)
20230 NEXT I
20240 '
20250 'CALCULATE  INDEX:
20260 NU = (S4 - S1*S2/(M/2))/(S3 - S1*S1/(M/2))
20270 '
20280 RETURN
20290 '====================  END POWER FIT  =====================
```

A Musical Synthesizer for the KIM-1



By Jed Margolin

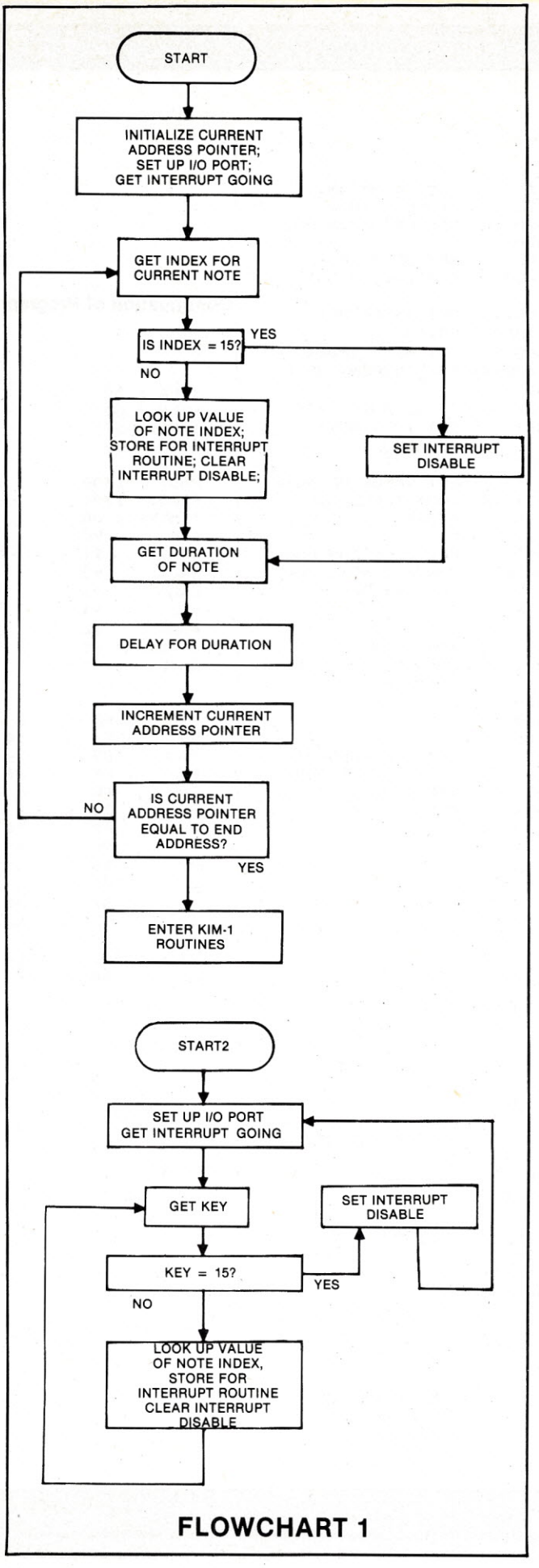
This article describes a simple music synthesizer implemented on a MOS Technology KIM-1. The flowchart is shown in Figure 1. There are two parts to the program. One uses the keypad to produce the notes assigned to them in real time and the other plays a score programmed in packed form in any specified block of memory. In both cases the number of the key (0-E) is used as an index to find the appropriate timing information for the programmable interval timer. The values given in the table are labeled C through D for convenience. The actual numbers (and frequencies) are normalized to give the best frequency resolution.

The scale is, however, equally tempered, at least as much as it is possible to be with 8 bits. An equally tempered scale is one in which each note is the same ratio to its neighbor. Most western music uses a twelve tone scale, with octaves being ratios of two. Each semi-tone ratio for an equally tempered scale is therefore:

$\sqrt[12]{2}$, or approximately 1.0595_{10}.

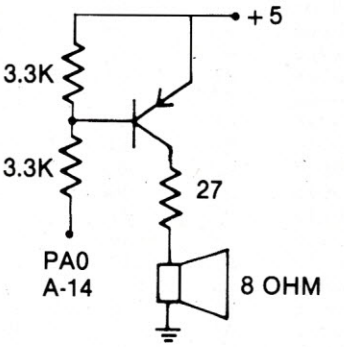
The only hardware required in addition to the KIM-1 is the circuit shown in Figure 2. You might recognize it as the one on page 57 of the KIM-1 Users Manual.

The entire program makes use of the programmable interval timer in the interrupt mode to generate the notes. It is



FLOWCHART 1

therefore necessary to connect PB7 (Application Connector pin 15) to IRQ (maskable interrupt, Expansion Connector pin 4). In other uses it could alternatively be connected to NMI (the non-maskable interrupt). However, in this synthesizer application, musical pauses are generated by setting the interrupt disable; thus, IRQ must be used. Besides, it is convenient to use NMI for starting the program because it also connected to the 'ST' button on the keypad.



Resistors are ¼ W. 10%
Transistor is practically any PNP

Figure 1.

The address pointer for NMI is located in addresses 17FA and 17FB. Locations 17FE and 17FF contain the address pointer for IRQ. PB7 must be programmed as input to allow operation of the interval timer in the interrupt mode; it comes up this way after RESET. In the case of the stored musical selection, the note duration is timed through software delays.

To use the keypad, load the following:

17FA = 62
17FB = 00
17FE = 57
17FF = 00
Press RS, ST.

To play a stored selection, each byte is packed with the least significant four bits selecting the note index and the most significant four bits indicating the relative duration of the note. SAL and SAH point to the first location of the selection; EAL and EAH point to the last location to be played.

As an example, try "Mary Had A Little Lamb." After loading the code in Program 2, press RS and ST.

Assuming success, try the special mystery tune in Program 3.

The only things stored on the stack by an interrupt request are the program counter and the status register. This program uses the accumulator during the interrupt routine so it is necessary to save it. The easiest way to do this is to push it on the stack at the beginning of the routine and pull it from the stack at the end.

Note that only the accumulator can be pushed on or pulled from the stack. The X and Y registers must undergo the appropriate accumulator transfers if they are to be saved. This program does not use the X or Y registers during the interrupt routine, so they don't have to be saved.

During the interrupt routine, the operation performed is to increment PAD. This eliminates the need to set it to an initial state at the beginning of the program and also provides lower octaves that may be used. (The frequency at PA1 is half that at PA0 and so on.)

If it is possible to hook it up to a stereo, some sort of low pass filter would probably be in order because of the fast risetime of the squarewave.□

Program Follows

PROGRAM 1

```
ADR     OP      Operand
0000    A5      90      START   LDA     SAL     LOAD STARTING
0002    85      94              STA     ADL     ADDRESS INTO
0004    A5      91              LDA     SAH     CURRENT ADDRESS
0006    85      95              STA     ADH
0008    A9      FF              LDA     #FF     SET UP OUTPUT
000A    8D      01  17          STA     PADD    PORT AS OUTPUT
000D    58                      CLI
000E    A9      08              LDA     #08     GET INTERRUPT
0010    8D      0D  17          STA     TIMER   GOING
0013    A2      00      GO      LDX     #00     GET NOTE INDEX
0015    A1      94              LDA     (ADL,X) FOR CURRENT NOTE
0017    29      0F              AND     #0F
0019    C9      0F              CMP     #0F     IF NO NOTE (=0F)
001B    D0      04              BNE     BR1     SET INTERRUPT
001D    78                      SEI             DISABLE
001E    4C      27  00          JMP     BR2
0021    AA              BR1     TAX             GET VALUE OF NOTE
0022    B5      97              LDA     NOTE,X  FROM TABLE AND
0024    85      96              STA     TIME    STORE
0026    58                      CLI
0027    A2      00      BR2     LDX     #00     GET DURATION FOR
0029    A1      94              LDA     (ADL,X) CURRENT NOTE AND
002B    29      F0              AND     #F0     PROVIDE DELAY
002D    20      4C  00          JSR     DUR
0030    18                      CLC
0031    A5      94              LDA     ADL     INCREMENT
0033    69      01              ADC     #01     CURRENT ADDRESS
0035    85      94              STA     ADL     POINTER
0037    A5      95              LDA     ADH
0039    69      00              ADC     #00
003B    85      95              STA     ADH
003D    A5      94              LDA     ADL     COMPARE CURRENT
003F    C5      92              CMP     EAL     ADDR TO END ADDR
0041    D0      D0              BNE     GO      RTN TO GO. IF =
0043    A5      95              LDA     ADH     RTN TO KIM.
0045    C5      93              CMP     EAH
0047    D0      CA              BNE     GO
0049    4C      00  1C          JMP     KIM

004C    A8              DUR     TAY
004D    A2      D0      LP1     LDX     #D0
004F    CA              LP2     DEX
0050    EA                      NOP
0051    D0      FC              BNE     LP2
0053    88                      DEY
0054    D0      F7              BNE     LP1
0056    60                      RTS

0057    48              INT     PHA             STORE ACCUM
0058    EE      00  17          INC     PAD
005B    A5      96              LDA     TIME
005D    8D      0D  17          STA     TIMER
0060    68                      PLA             RESTORE ACCUM
0061    40                      RTI
0062    A9      FF      START2  LDA     #FF     SETUP OUTPUT
0064    8D      01  17          STA     PADD
0067    58                      CLI
0068    A9      08              LDA     #08     GET INTERRUPT
006A    8D      0D  17          STA     TIMER   GOING
006D    20      19  1F  KEPAD   JSR     SCANDS  GET KEY VALUE
0070    20      6A  1F          JSR     GETKEY
0073    C9      15              CMP     #15     IF=15 NO KEY
0075    D0      04              BNE     BR3
0077    78                      SEI
0078    4C      6D  00          JMP     KEPAD
007B    AA              BR3     TAX             GET VALUE OF
007C    B5      97              LDA     NOTE,X  NOTE FROM TABLE
007E    85      96              STA     TIME    AND STORE FOR
0080    58                      CLI             INTERRUPT
0081    4C      6D  00          JMP     KEPAD
```

Continuation of Program 1

```
17FA = 00
17FB = 00
17FE = 57
17FF = 00

PAD.    1700
PADD.   1701
TIMER.  170D
SAL.      90
SAH.      91
EAL.      92
EAH.      93
ADL.      94
ADH.      95
TIME.     96
NOTE.     97

97      EE      C
98      E1      C#
99      D5      D
9A      C9      D#
9B      BE      E
9C      B3      F
9D      A9      F#
9E      9F      G
9F      96      G#
A0      8E      A
A1      86      A#
A2      7F      B
A3      77      C
A4      71      C#
A5      6A      D
```

PROGRAM 2
"MARY HAD A LITTLE LAMB"

```
0090    00      SAL             17FA = 00
0091    01      SAH             17FB = 00
0092    27      EAL
0093    01      EAH             17FE = 57
                                17FF = 00
0100    F4      (E)
0101    F2      (D)
0102    F0      (C)
0103    F2      (D)
0104    F4      (E)
0105    1F       r - rest
0106    F4      (E)
0107    1F       r
0108    F4      (E)
0109    DF       r
010A    F2      (D)
010B    1F       r
010C    F2      (D)
010D    1F       r
010E    F2      (D)
010F    DF       r
0110    F4      (E)
0111    F7      (G)
0112    1F       r
0113    F7      (G)
0114    FF       r
0115    F4      (E)
0116    F2      (D)
0117    F0      (C)
0118    F2      (D)0119 F4      (E)
011A    1F       r
011B    F4      (E)
011C    1F       r
011D    F4      (E)
011E    24      (E)
011F    1F       r
0120    F4      (E)
0121    F2      (D)
0122    1F       r
0123    F2      (D)
0124    F4      (E)
0125    F2      (D)
0126    F0      (C)
0127    F0      (C)
```

PROGRAM 3
"SPECIAL MYSTERY TUNE"

```
0090    30      EAL
0091    01      SAH
0092    72      EAL
0093    01      EAH
0130    =       F0
                A7
                FC
                FC
                CB
                A7
                A4
                A9
                FE
                FE
                FE
                FE
                FF
                FF
013E    =       F0
                F0
                FA
                FA
                F9
                D7
                D5
                D4
                F3
                F3
                F3
                FF
014A    =       F1
                F0
                F0
                FC
                FC
                FA
                D9
                C7
                C5
                F4
                F4
                F4
                FF
0157    =       C3
                F2
                D2
                D4
                D5
                D7
                B9
                BA
                BC
                FD
                FD
                AF
0163    =       FE
                FE
                DC
                FA
                FA
                F7
                F7
                F7
                F9
                F9
                F5
                F5
                F5
                F5
                F5
0172    =       FF
```

Micro Database Management Systems

By Del J. Cornali

Although revolution upon revolution has seized and shaken the computer industry since its inception some thirty years ago, no other single technological advance portends to disrupt the status quo of the data processing arena as the advent of the prepackaged microprocessor computer. Only during the past year has the first light of this revolution appeared on the horizon.

The micro-revolution will not only revise the shape and form of future computers, but will also mollify and reshape the attitude of society towards computers, a task proven incapable of solution by any previous computer hardware. The low price of the average micro has placed it within financial reach of most Americans. Accordingly, data processing power is no longer limited to only large financial and educational institutions. This heretofore expensive power is now available to small businesses, doctors, lawyers, and educators on all levels. The size of this processor enables specific computer systems to become functional in automobiles, home, energy systems, guided weaponry, aircraft and hundreds of other uses. Hostile environments which previously prevented computer use can now employ the highly reliable, accurate, and fast microcomputer.

Several major changes in the Data Processing environment have occurred since 1968. The introduction of the minicomputer marked a significant breakthrough for DP operations as a whole. Although the minicomputer was heralded as the new "Messiah" by the DP community, the mini still retained enough of the features of its predecessor so as to remain merely a small computer. The transposition of software from mainframe to mini poses no serious problems. Moreover, the complexities and cost of the minicomputer prevented the small businesses and households from acquiring and using the minicomputer.

With the introduction of the microcomputer, however, computer professionals faced the reality of reinventing application packages for this new computer family member. But professional software is not yet available for micro-based systems. The fact that this professional software has yet to surface can be explained by any combination of reasons. Certainly a good number of computer professionals have turned away from microprocessor software because of the lack of financial support. The giants of the computer industry have yet to grant their blessing and have remained out of the microprocessing arena. As a result, the gargantuan task of wheel inventing has fallen to the hobbyist and the moonlighting computer programmer.

Despite the large numbers of these hearty souls, their work has resulted in relatively little good software and a great deal of the poorer variety: the former coming from "mainframes" with the necessary educational and practical experience, and the latter coming from the inexperienced and uneducated hobbyist.

One area of the software spectrum particularly rare is business-oriented software. Although software for general payroll, accounts receivable, accounts payable, and inventory control are available, no real Generalized Data Base Management System has surfaced to fill this enormous void. Moreover, the lack of any microbased Management Information System has also left business in a state of indecision. Without direction from the data processing professional, most small businesses are reluctant to tred on unproven ground.

As the title implies, this article will delve into the feasibility of database managment systems for microprocessors. After discussing the need for such systems, this article will determine the specifications, data structures, and the use of structured programming for implementing GDBMS. This article will also touch on the use of Management Information Systems (MIS) for microcomputers.

NECESSITY

A number of causes can be traced to the sudden success of the microcomputer in 1977. Whether it be its low cost, appeal to the hobbyist and off-duty computer professional, or merely the status and power of having one's own computer is actually superfluous to the intent of this article. This tremendous influx caused by the micro has created a chasm between the available hardware and an already depleted software reservoir. As hardware manufacturers and marketing agencies continue to seek larger and larger followings, this chasm widens. Not only are they producing more hardware thereby increasing the ratio of hardware to software, they effect a greater realization among small businessmen, especially young professionals, of what the microprocessor can mean to their financial success.

In several ways, the "software reservoir," that is the pool of available computer programs, can be likened to a gaseous entity in its response to different stimuli. In the same way that a gas will always fill any given volume, so too will the availability of business-oriented software fill any given demand for that software. But as the demand for that software rises, the average quality of that software diminishes, just as the density of a gas will diminish in a larger volume.

Therefore, the newly established data processing market for microprocessors demands quality software. If this market is to survive, however, computer professionals must redesign and reconfigure generalized database management systems and management information systems for microprocessor residency. Without a GDBMS over-the-counter sales of micros will soon recede since only an audience of hobbyists and gaming/simulation enthusiasts can afford to purchase such "barren" hardware. If these tools cannot become readily available to the average small businessman, a great market could easily slip past the micro-based Data Processing professionals.

SYSTEM SPECIFICATIONS

It would be a serious mistake to leave unstated the capabilities and limitations of a micro-based GDBMS merely because such systems have already been developed for both the mainframe and mini computers. Utilizing a micro imposes several obvious limitations which preclude and limit the power of any management system. Furthermore, any management system developed specifically for micros must be available without the addition of expensive peripherals and random access memory; their addition would price it out of the range of the small businessman.

One category of specifications arises from the size and power of a microprocessor. Specifically, a database management system must be sufficiently compact so that the GDBMS and the data segments can reside in memory simultaneously. However, this limitation should not restrict the

maximum file size. The analyst of such a system must enable the user to systematically overlay pages of the data file into the computer. This may be done programmatically in an on-line scheme from floppy disk or in a less exotic and less expensive manual method from off-line cassette tape. Assuming that the average merchant who is just starting to automate some function of this business will be limited to an initial hardware investment of $4,000 or less, such a GDBMS should require between 6K and 10K of RAM. This would leave 6K to 18K for data files.

Selection of source language is also an important consideration. The systems analyst preparing to implement a data design may be forced to implement BASIC or to program at the assembly level or to procure or design COBOL for his micro. Certainly each of the choices possesses definite drawbacks: BASIC by its maladroit character handling, assembly by its short-stroking inability to structure, and COBOL by its unavailability. The systems analyst must then choose the method which best suits his experience and knowledge.

By the fact that we are designing a GDBMS/MIS, the system's specifications must presuppose the functions of such systems. Strict database management requires the ability to add, delete, and update records at a minimum. Other commands may allow recursive calls on these commands or may pass special parameters to these basic commands. Also, additional commands must allow the user to completely traverse a file for printing, sorting, or summing purposes. A micro-based MIS should allow a user, at a minimum, to select, sort, and print records of a file based on the content of those records.

The asset readily accessible . . .is the processor. . .the analyst can. . .dedicate his processor to his function. . .

In consideration of the restraints imposed by the limited memory size, the systems analyst must employ the greatest efficiency as possible to render the greatest system capability at the lowest cost of RAM. Moreover, enough flexibilty must be written into the system design to implement future developments and enhancements while maintaining the same basic structure.

The importance of the previous statement cannot be over emphasized. Since these general software systems are initially designed for extremely small firms and practices, their capacity to tremendously increase in size forces the analyst to build a structured software approach flexible enough to accommodate future enhancements such as multiple files, multiprocessing/multitasking, accounts control, and distributed processing. In view of these remarks, therefore, this author submits that any long-range data systems design for micros must incorporate well written and internally documented structured code and must reflect a top-down design. Although no language available for microprocessors fully fulfills this need, BASIC may best approach a structured language, despite its drawbacks.

DATA STRUCTURES

Full consideration of appropriate data structures is inherent to the design of any system which must function under the severe constraints of the microcomputing environment. Data structures appropriate for the microprocessor must afford the power of some rather exotic data structures while preserving valuable computer resources.

The suitable data structure can only be identified after extensive study of the available resources. Obviously, RAM must be considered at a premium. The lack of this resource limits filesize, record length, program capabilities, and proper documentation. The asset readily accessible to the analyst is the processor itself. Although the processor is one of the least expensive features of his machine, the analyst can completely dedicate his processor to his function alone, facts that timesharing and multiprogramming systems cannot boast.

So, a tailored GDBMS can concentrate its attention on forcing the processor to work while conserving as much memory as possible. Furthermore, data structures can reflect these policies toward processor utilization.

Several general data structures are available which preserve data control without sacrificing a large memory overhead. Records stored serially within a file present a structure requiring virtually no overhead. However, the serial file lacks sufficient controls which will prevent the processing of exceedingly large files. The hashing technique of storing records based on their contents requires no additional record storage and utilizes processor power to handle recursive rehashing. However, the general inefficiency of storage space for files greater than 80% full can easily disqualify using such a technique for a GDBMS. Linked lists can rob up to 10% of a data file for merely record maintenance.

One data structure may afford the efficiency of the serial structure and the power of a hash table or linked list. Implementation of this structure requires only a small number of bytes irrespective of file size or record size. In this approach, records are serially added to the bottom of a data file. A vector points to the next location of continuous available space. All records beyond this pointer are empty and available, while any records up to this point may be full. As space becomes available below the NEXT-AVAILABLE pointer via record deletions, the address of the available record is pushed onto a STACK OF AVAILABLE SPACE. As memory is required for future additions, already available space below NEXT AVAILABLE is popped from the stack. Since only unused records are linked, this technique saves a tremendous amount of valuable memory while accounting for all available space which neither a linked list nor a hash table can accomplish.

A second data structure must also be designed which incorporates as much flexibility as possible into the software. A CONTROL FILE data structure represents the overhead for the data file. A fixed length structure embedded into the database enables a GDBMS to identify and locate required data of any database as determined by queries of the CONTROL FILE.

As stated previously, any overhead whatsoever reduces the effectiveness of the data package. However, if the addition of this control file can augment system flexibility, its inclusion becomes cost effective to the DBMS. This control file can ultimately be used as the program/data interface for management information systems, retrieval systems, or generalized database definition systems. The data typically incorporated into a control file should include items such as title, data type and length for each field, file title, record length, file type and resident locations for the head of the stack of available space, and the next available vector.

STRUCTURED PROGRAMMING

Inclusion of the structured programming philosophy into the microprocessing field may prove to be the microcomputer's best improvement of all. Structured programming can provide systems analysts the tools necessary to build logical, independent blocks of code which are not only more readable but also easier to implement, maintain and modify. Using the top-down approach, a systems analyst can end the "Kludge" syndrome suffered by most micro-oriented programmers.

A programmer will be able to employ structured programming techniques at various stages of software design. A

driver section is critical to implementation. This block reflects the overall logic of the entire program by relying on the program's main procedures to perform most of the necessary work. Although the shortest section of the program, it can spell success or failure for a program since it mimics the first level of the design. Therefore, a driver section for a generalized DBMS may look like the following:

```
 90  REM DRIVER
100  GOSUB INITIALIZE
110  GOSUB COMMAND
120  GOSUB BRANCH * 100
130  GOTO 110
```

In this example, the driver calls an initialization routine. Then, the driver continually requests and executes commands placed by the user. The variable BRANCH is used as a parameter passed from COMMAND to statement 120. Although the above code does not appear structured, a different language could reflect the above driver as:

```
INITIALIZE;
WHILE TRUE DO
    BEGIN
    COMMAND;
    CASE COMMAND OF
    •
    •
    •
    END CASE;
    END;
```

The structuring of the various commands is another facet of the SP regimen which yields efficient and effective code. An example of this will illustrate how efficiently code can be written if a set of commands are made subordinate to other commands. For example, assume a subroutine entitled PULL is responsible for extracting a string of characters representing an element of a record. If the user wishes to SELECT a record, PULL must be repeatedly called to fetch each field. If the user wishes to DUMP an entire file, he can repeatedly execute a SELECT for each record of that file. Structuring commands or routines in this way allows the programmer to place as much power and clarity into his code, while at the same time saving as much memory as possible.

Structuring can be enhanced by passing parameters from one routine to the next. Although BASIC is not capable of true parameter passing (all variables are global or common to the entire program), this can be simulated by using identifiers for that explicit purpose. The use of structured programming, therefore, can benefit the designer of any micro-based Data Base Management system.

MANAGEMENT INFORMATION SYSTEMS

Although this article has gone to great lengths identifying and then quantifying the necessity of micro-based database management systems, the maintenance of such databases is an end in itself. Although micros can afford excellent audit and data control capabilities, the worth of the microcomputer becomes significant if the micro can furnish statistical data and data analysis to the businessman. Hence, the Management Information System will provide the tools with which a businessman can wield enormous managerial prowess.

Implementation of an MIS onto a microprocessor warrants further discussion. Considering the extreme RAM limitations of the micro, it is probably impossible to co-locate a DBMS and an MIS simultaneously in memory. In all probability then, a user would pull his data management program to perform actual changes to the database and then swap in the MIS to run any specified reports he wishes to generate. Since these two systems cannot run simultaneously, the MIS may only occupy as much RAM allocated for the DBMS. Therefore, the size of this software package is limited to between 6K and 10K.

Even with these severe limitations, it is possible to design an information system capable of producing very specific detailed information. However, these capabilities can be implemented only if the programmer designs his system in a structured, top-down scheme. Any prototype MIS should be designed to allow the user to select records based on data actually stored in those records. For example, if a manager wishes to see a list of clients who have balances outstanding, he could enter:

```
SELECT: BALANCE > 0.00
```

An in-depth select statement capability allowing up to four in dependent selects can be engineered into the MIS. The option of selecting all records should also be available. Allowing the user to control the output format is a second capability of a well-designed MIS. These statements should include a sort of the file on any data field, either ascending or descending, and the order he wishes the data fields presented.

Other numerical information is required for such a system. The user should be able to perform totals and averages on the contents of numeric data as well as tallying the number of selected records. To illustrate further with the previous example, the entire data retrieval could appear as the following:

```
FILE:     ACCOUNTS RECEIVABLE
SELECT:   BALANCE > 0.00
          DUE-DATE < 780130
OUTPUT:
SORT:     ASCENDING NAME
TOTAL     BALANCE
TALLY:
PRINT:    NAME, ADDRESS, CITY, STATE, DUE-DATE, BALANCE
END:
```

Providing business managers with useful, current information has in the past come under the jurisdiction of the mainframe computer. Once database management and information systems are developed for microcomputers, this valuable information may become available to businesses of all varieties.

SUMMARY

Without a doubt, the design and implementation of a data base management system/management information system for state-of-the-art microcomputers poses significant software problems, which this article has enumerated in detail. Certainly not all of the capabilities of a GDBMS designed for larger, more powerful computers can be incorporated into such a small machine, but the capabilities required by small businesses, educators, and other professionals can be fulfilled by the microprocessor.

The necessity of well-written, well-documented, business oriented systems cannot be over-stated. This article details the specifications of such a system, and proposes the data structures and the use of structured programming necessary to implement this software. Further, the article illustrates the requirement for and feasibility of Management Information Systems for microcomputers.

CONCLUSION

Technology has provided society with a device that not only possesses computing power which 50 years ago could be conservatively termed immense, but also offers the device to the average American with all the nonchalance typical of "just another moon shot." Once small, personal computers can be offered to the populace, society's attitudes towards computers will reverse the trend set by the ungainly digital monsters of the early 1960s.

Although the revolution sparked by the microcomputer may wreak havoc among incumbent mainframe digital computer *aficionados,* this "people's revolution" may reshape the appearance and acceptance of computers by generations of Americans for years to come.□

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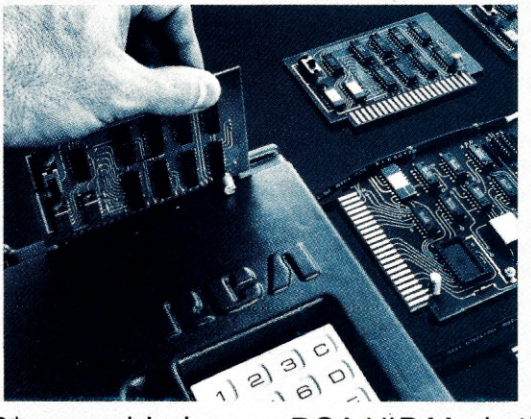

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The fun way into computers.

RCA

Income Averaging Program

By J. Dunn and M. Farris

Something which affects all of us at least once a year is income tax. If you are expecting a refund, tax season can be something you look forward to. On the other hand, if your "ship came in" this past year, Uncle Sam will definitely be asking for his share, and you will be frantically trying to find ways to decrease the government's portion of your income. One advantage the government has given you is the ability to average your income (according to the government's rules) to possibly reduce the amount of your income tax.

The form provided by the IRS for the use of income averaging is Schedule G. The main purpose of income averaging is to reduce your tax liability for the years in which your income has increased substantially. The income averaging method allows large portions of income to be taxed at lower rates, which results in a lower tax for you.

The IRS has certain restrictions regarding those eligible to take advantage of the income averaging benefits. A few of the more important restrictions are as follows:

1. The person must be a citizen or resident of the United States.
2. The person must have furnished at least 50% of his own support.
3. The person must be 25 years of age or older.
4. The person cannot have been a full-time student in the calculation year or any of four preceding years.

Other rules and exceptions to the rules apply in certain circumstances. We recommend referring to IRS Publication 506 for a more complete and concise listing of eligibility requirements and exceptions to the requirements.

To understand what the income averaging program is asking at various input points and to understand the workings of the program, a basic familiarity with some of the terms is required. Following are some of the more used terms.

Computation Year The current year for which the tax liability is being computed. Our program is set up to compute the income tax for the 1977 tax year. Thus, 1977 is the computation year.

Base Period Years Each of the four years preceding the computation year are considered base period years. As our program stands now, the base period years are '76, '75, '74 and '73.

Taxable Income If the optional tax tables were used in a base period year, the Taxable Income will be computed from the *adjusted gross income* which the user will input. If tax tables were not used, Taxable Income can be found for each year as follows:

Year	Form	Line Number
76 & 75	1040	47
76	1040A	15
75	1040A	5
74 & 73	1040	48
74 & 73	1040A	16

Adjusted Gross Income For base period years in which option-optional tax tables were used, the Adjusted Gross Income figure will be asked for. Adjusted Gross Income can be found in the base period year's tax return as follows:

Year	Form	Line Number
76	1040	47
75, 74, 73	1040	15
75, 74, 73	1040A	12

72-M-5 Penalty This penalty applies to a premature distribution of an employee's qualified pension plan. In situations where the 72-M-5 Penalty applies, we suggest that you refer to IRS Publication 506.

Excess Community Income This can apply only to a couple with a filing status of "Married Filing Separately." Once again we suggest that you refer to IRS Publication 506 for full details on this subject.

When using income averaging there are some rules that have to be followed to obtain proper results. One area where the IRS rules play a important part is that of marital status. If marital status for any base period year differs from the marital status of the computation year, adjustments will be necessary. For details and examples of varying marital status, we suggest you refer to IRS Publication 506.

Another item that may differ from year to year is the total number of exemptions claimed. The program asks for the total number of exemptions each year, and the user of the program should supply the program with the correct number of exemptions for that specific year. The exemptions can be found for each year's tax return on the first page of 1040 near the top.

The program computes averageable income, taxable income, and the income tax as computed by use of income averaging. Included in the printout is a complete listing and correct figures for Schedule G and part I of Schedule TC. Along with the listings of these schedules appears a diagnostic of the program. The diagnostic will list the filing status and number of dependents for each year involved in the calculation. This provides the user with a quick and easy check to verify that the correct information was supplied to the program.

This program was written in North Star BASIC. It was designed to require minimal storage and have maximum compatibility with North Star systems. Also, the program should be compatible with other versions of the BASIC language with only moderate changes.

The income averaging program is an example of how computers can be used in tax accounting. By automating the tax preparation system, more thorough, efficient, and accurate computation and review of tax returns will result. The microprocessor will be able to provide the speed, efficiency and accuracy of computers to the smallest accounting firms or businesses. As the computer makes its way into all accounting firms, it will eventually be possible for every client's tax return to be checked for every possible tax savings.

It will someday be possible to purchase a tax program which will compute every aspect of every type of tax return. At the present, such a program would be expensive and hard to obtain.

The computer cannot be relied upon to make correct value judgments at this stage, but can be of great assistance on time-consuming applications such as income averaging. Human judgment and logic are still necessary to obtain proper results in all areas of tax accounting.□

SAMPLE RUN

```
                    TAX COMPUTATION SCHEDULE-1040 T C
                          1977 TAX YEAR


1 ENTER YOUR TAXTABLE INCOME FROM FORM 1040.....    52988.25
2 MULTIPLY $750 BY THE TOTAL NUMBER OF EXEMPTIONS.   2250.00
3 TAXABLE INCOME.  SUBTRACT LINE 2 FROM LINE 1.....  50738.25
4 INCOME TAX FROM SCHEDULE G.....                    10280.15

GENERAL TAX CREDIT

5 ENTER $35 MULTIPLIED BY TOTAL NUMBER OF EXEMP...     105.00
6 ENTER AMOUNT FROM LINE 3 ABOVE.....               50738.25
7 ENTER ZERO BRACKET AMOUNT.....                     3200.00
8 SUBTRACT LINE 7 FROM LINE 6.....                  47538.25
9 ENTER 2 PERCENT OF LINE 8(BUT NO MORE THEN $180.    180.00
10 GEN.  TAX CREDIT.  LARGER OF LINE 5 OR LINE 9....  180.00
11 TAX.  SUBTRACT LINE 10 FROM LINE 4.....          10100.15



                    INCOME AVERAGEING-FORM 1040, SCHEDULE G
                          1977 TAX YEAR


                    (A)          (B)          (C)          (D)
                    1ST          2ND          3RD          4TH
                PRECEEDING   PRECEEDING   PRECEEDING   PRECEEDING
                BASE PERIOD  BASE PERIOD  BASE PERIOD  BASEPERIOD
                   YEAR         YEAR         YEAR         YEAR
1 TAXABLE
  INCOME        6302.70      2502.99      7845.98      2542.60
2 INCOME
  EARNED
  OUTSIDE
  U. S.            .00          .00          .00          .00
3 ZERO
  BRACKET       3200.00      3200.00      3200.00      3200.00
4 BASE
  PERIOD
  INCOME        9502.70      5702.99     11045.98      5742.60

COMPUTATION OF AVERAGEABLE INCOME

5 TAXABLE INCOME FOR 1977 FROM SCHEDULE TC.....     50738.25
6 AMOUNTS SUBJECT TO PENALTY UNDER SEC. 72(M)(5).       .00
7 SUBTRACT LINE 6 FROM LINE 5.....                  50738.25
8 EXCESS COMMUNITY INCOME.....                          .00
9 ADJUSTED TAXABLE INCOME(LINE 7 LESS LINE 8)....   50738.25
10 30% OF THE SUM OF LINE 4, COLUMNS (A) THRU (D)    9598.28
11 AVERAGEABLE INCOME (LINE 9 LESS LINE 10).....    41139.97

     COMPLETE THE REMAINING PARTS OF THIS FORM ONLY IF
     LINE 11 IS MORE THEN $3,000.00.

COMPUTATION OF TAX

12 AMOUNT FROM LINE 10.....                          9598.28
13 20% OF LINE 11.....                               8227.99
14 TOTAL (ADD LINES 12 AND 13).....                 17826.28
15 EXCESS COMMUNITY INCOME FROM LINE 8.....             .00
16 TOTAL (ADD LINES 14 AND 15).....                 17826.28
17 TAX ON AMOUNT ON LINE 16.....                     2916.57
18 TAX ON AMOUNT ON LINE 14.....                     2916.57
19 TAX ON AMOUNT ON LINE 12.....                     1075.67
20 SUBTRACT LINE 19 FROM LINE 18.....                1840.90
21 MULTIPLY THE AMOUNT ON LINE 20 BY 4.....          7363.58
22 TAX ON AMOUNT ON LINE 5.....
23 TAX ON AMOUNT ON LINE 7.....
24 SUBTRACT LINE 23 FROM LINE 22.....
25 TAX(ADD LINES 17,21,24) ENTER HERE AND ON TC..    10280.15


COMPUTATIONS AN THIS PAGE ARE NOT REQUIRED UNLESS YOU
USED THE OPTIONAL TAX TABLES FOR 1975, 1974, OR 1973.

COMPUTATION OF TAXABLE INCOME FOR 1975 IF YOU USED
THE OPTIONAL TAX TABLES.

1 ENTER AMT.  FROM 1040, LINE 15 OR 1040A, LINE 12.
2(A) ENTER 16% OF LINE 1.....
2(B) ENTER STANDARD DEDUCTION LOWER LIMIT.....
2(C) STANDARD DEDUCTION [2(A) OR 2(B)(LARGEST)].....
3 SUBTRACT LINE 2(C) FROM LINE 1.....
4 MULTIPLY NUMBER OF EXEMPTIONS BY $750.....
5 TAXABLE INCOME (SUBTRACT LINE 4 FROM 3).....


COMPUTATION OF TAXABLE INCOME FOR 1974 AND 1973 IF
YOU USED THE OPTIONAL TAX TABLES.

                                          1974         1973
ENTER AMOUNT FROM:
 FORM 1040(1974 AND 1973),LINE 15
 FORM 1040A(1974 AND 1973),LINE 12...
2(A) ENTER 15% OF LINE 1.....
2(B) ENTER $1300(650 IF MS).....
2(C) STANDARD DEDUCTION.....
3 SUBTRACT LINE 2(C) FROM LINE 1.....
4 MULTIPLY TOTAL EXEMPTIONS BY $750..
5 TAXABLE INCOME(LINE 4 LESS 3).....


          **********DIOGNOSTICS**********


                          1973  1974  1975  1976  1977

TAX TABLES USED            N     N     N     NA    NA

NUMBER OF DEPENDENTS      NA    NA    NA    NA     3

FILLING STATUS FOR YEAR   NA    NA    NA    NA     M
**************************************END**********************
```

Program Follows

PROGRAM LISTING

```
10 GOTO 60
20 !\!\!\!\!\!\!\!
30 !\!\!\!\!\!\!\!
40 !\!\!\!\!\!\!\!
50 RETURN
60 GOSUB 20
70 INPUT "ENTER 4TH PRECEEDING BASE PERIOD YEAR TAXABLE INCOME: ",Y4
80 I4=Y4
90 GOSUB 20
100 INPUT "WERE TAXTABLES USED FOR 4TH PRECEEDING BASE PERIOD: ",Y4$
110 GOSUB 20
120 IF Y4$<>"Y" THEN 210
130 GOSUB 20
140 INPUT "ENTER NUMBER OF DEPENDENTS FOR YEAR: ",D4
150 GOSUB 20
160 !"S=SINGLE, M=MARRIED/JOINT, MS=MARRIED/SEPERATE, H=HEAD OF"
170 !"HOUSEHOLD, Q=QUALIFYING WIDOW(ER)."
180 !
190 INPUT "ENTER FILING STATUS: ",M4$
200 GOSUB 20
210 INPUT "ENTER 3RD PRECEEDING BASE PERIOD YEAR TAXABLE INCOME: ",Y3
220 I3=Y3
230 GOSUB 20
240 INPUT "WHERE TAXTABLES USED FOR 3RD PRECEEDING BASE PERIOD: ",Y3$
250 GOSUB 20
260 IF Y3$<>"Y" THEN 350
270 GOSUB 20
280 INPUT "ENTER NUMBER OF DEPENDENTS FOR YEAR: ",D3
290 GOSUB 20
300 !"S=SINGLE, M=MARRIED/JOINT, MS=MARRIED/SEPERATE, H=HEAD OF"
310 !"HOUSEHOLD, Q=QUALIFYING WIDOW(ER)."
320 !
330 INPUT "ENTER FILING STATUS: ",M3$
340 GOSUB 20
350 INPUT "ENTER 2ND PRECEEDING BASE PERIOD YEAR TAXABLE INCOME: ",Y2
360 W8=Y2
370 GOSUB 20
380 INPUT "WERE TAXTABLES USED FOR 2ND PRECEEDING BASE PERIOD: ",Y2$
390 GOSUB 20
400 IF Y2$<>"Y" THEN 490
410 GOSUB 20
420 INPUT "ENTER NUMBER OF DEPENDENTS FOR YEAR: ",D2
430 GOSUB 20
440 !"S=SINGLE, M=MARRIED/JOINT, MS=MARRIED/SEPERATE, H=HEAD OF"
450 !"HOUSEHOLD, Q=QUALIFYING WIDOW(ER)."
460 !
470 INPUT "ENTER FILING STATUS: ",M2$
480 GOSUB 20
490 INPUT "ENTER 1ST PRECEEDING BASE PERIOD YEAR TAXABLE INCOME: ",Y1
500 GOSUB 20
510 IF Y4$<>"Y" THEN 630
520 A=Y4*.15
530 L4=A
540 IF M4$<>"Y" THEN 590
550 IF A>1000 THEN A=1000
560 L4=A
570 IF A<650 THEN A=650
580 GOTO 610
590 IF A<1300 THEN A=1300
600 H4=A
610 A=A+(D4*750)
1270 IF A7<=3000 THEN 2140
1280 A6=A8+(.2*A7)+Y8
1290 GOSUB 1310
1300 GOSUB 1730
1310 IF M0$="S" THEN 1360
1320 IF M0$="M" THEN 1450
1330 IF M0$="MS" THEN 1540
1340 IF M0$="H" THEN 1630
1350 IF M0$="Q" THEN 1630
1360 OPEN #1,"TAXTAB1"
1370 FOR I=1 TO 25
1380 READ #1,I1,I2,T,P
1390 IF A6>I1 AND A6<I2 THEN 1410
1400 GOTO 1440
1410 V8=T+((P*.01)*(A6-I1))
1420 CLOSE #1
1430 EXIT 1720
1440 NEXT I
1450 OPEN #2,"TAXTAB2"
1460 FOR I=1 TO 25
1470 READ #2,I1,I2,T,P
1480 IF A6>I1 AND A6<I2 THEN 1500
1490 GOTO 1530
1500 V8=T+((P*.01)*(A6-I1))
1510 CLOSE #2
1520 EXIT 1720
1530 NEXT I
1540 OPEN #3,"TAXTAB3"
1550 FOR I=1 TO 25
1560 READ #3,I1,I2,T,P
1570 IF A6>I1 AND A6<I2 THEN 1590
1580 GOTO 1620
1590 V8=T+((P*.01)*(A6-I1))
1600 CLOSE #3
1610 EXIT 1720
1620 NEXT I
1630 OPEN #1,"TAXTAB4"
1640 FOR I=1 TO 33
1650 READ #1,I1,I2,T,P
1660 IF A6>I1 AND A6<I2 THEN 1680
1670 GOTO 1710
1680 V8=T+((P*.01)*(A6-I1))
1690 CLOSE #1
1700 EXIT 1720
1710 NEXT I
1720 RETURN
1730 V1=V8
1740 A6=A8+(.2*A7)
1750 GOSUB 1310
1760 V2=V8
1770 A6=A8
1780 GOSUB 1310
1790 V3=(V2-V8)*4
1800 IF Y9=0 THEN 1890
1810 A6=Y0
1820 GOSUB 1310
1830 V4=V8
1840 A6=Y0-Y9
1850 GOSUB 1310
1860 V5=V8
1870 V6=V4-V5
1880 GOSUB 20
1890 GOSUB 20
1900 X5=V1+V3+V6
```

```
620 Y4=Y4-A
630 IF Y4$<>"Y" THEN 750
640 A=Y3*.15
650 L3=A     MS
660 IF M3$<>"Y" THEN 710
670 IF A>1000 THEN A=1000
680 L3=A
690 IF A<650 THEN A=650
700 GOTO 730
710 IF A<1300 THEN A=1300
720 H3=A
730 A=A+(D3*750)
740 Y3=Y3-A
750 IF Y2$<>"Y" THEN 1030
760 A=Y2*.16
770 IF M2$<>"M" THEN 810
780 IF A>2400 THEN A=2400
790L2=A
800 GOTO 960
810 IF M2$<>"Q" THEN 850
820 IF A > 2400 THEN A = 2400
830 L2 = A
840 GOTO 960
850 IF M2$<>"S" THEN 890
860 IF A>2300 THEN A=2300
870 L2 = A
880 GOTO 960
890 IF M2$<>"H" THEN 930
900 IF A>2300 THEN A=2300
910 L2 = A
920 GOTO 960
930 IF M2$<>"MS" THEN 960
940 IF A>1300 THEN A=1300
950 L2 = A
960 IF M2$="M" THEN B=1900
970 IF M2$="S" THEN B=1600
980 IF M2$="H" THEN B=1600
990 IF M2$="MS" THEN B=950
1000 IF B>A THEN A=B
1010 A=A+(D2*750)
1020 Y2=Y2-A
1030 INPUT "ENTER THIS YEARS TAXTABLE INCOME: ",Y0
1040 GOSUB 20
1050 !"S=SINGLE, M=MARRIED/JOINT, MS=MARRIED/SEPERATE, H=HEAD OF"
1060 !"HOUSEHOLD, Q=QUALIFYING WIDOW(ER)."
1070 !
1080 INPUT "ENTER FILING STATUS: ",M0$
1090 GOSUB 20
1100 INPUT "ENTER NUMBER OF DEPENDENTS FOR THIS YEAR: ",D0
1110 GOSUB 20
1120 INPUT "ENTER SECTION 72(M)(5) PENALTY: ",Y9
1130 IF M0$<>"MS" THEN 1160
1140 GOSUB 20
1150 INPUT "ENTER EXCESS COMMUNITY INCOME: ",Y8
1160 Z1=D0*750
1170 Z2=Y0
1180 Y0=Y0-Z1
1190 A9=Y0-Y9-Y8
1200 IF M0$="S" THEN S=2200
1210 IF M0$="M" THEN S=3200
1220 IF M0$="MS" THEN S=1600
1230 IF M0$="H" THEN S=2200
1240 IF M0$="Q" THEN S=3200
1250 A8=(Y1+Y2+Y3+Y4+(S*4))*.3
1260 A7=A9-A8
```

```
1910 FOR I=1 TO 8
1920!"*****************************************************************"
1930 NEXT I
1940 G1=D0*35
1950 IF M0$="MS" THEN 2000
1960 IF M0$="M" THEN G2=(Y0-3200)*.02
1970 IF M0$="S" THEN G2=(Y0-2200)*.02
1980 IF M0$="H" THEN G2=(Y0-2200)*.02
1990 IF M0$="Q" THEN G2=(Y0-3200)*.02
2000 G0=G1
2010 IF G2>180 THEN G2=180
2020 IF G2>G1 THEN G0=G2
2030 IF G0>180 THEN G0=180
2040!"**************TAX USING INCOME AVERAGING=",%10F2,X5,"*************"
2050!"**************LESS: GENERAL TAX CREDIT  =",%10F2,G0,"*************"
2060!"**************                           ----------**************"
2070 Z6=X5-G0
2080!"**************NET TAX                   =",%10F2,Z6,"*************"
2090 FOR I=1 TO 8
2100!"*****************************************************************"
2110 NEXT I
2120 INPUT "DO YOU WANT A PRINT-OUT: ",P$
2130 GOTO 2160
2140 !"INCOME AVERAGE IS DISALLOWED.  AVERAGEABLE INCOME IS LESS"
2150 !"THEN $3000.00"
2160 !
2170 IF P$<>"YES" THEN 5070
2180!#1,"                          TAX COMPUTATION SCHEDULE-1040 T C"
2190!#1,"                                  1977 TAX YEAR"
2200 !#1," "
2210 !#1," "
2220!#1,"1 ENTER YOUR TAXTABLE INCOME FROM FORM 1040.....",%10F2,Z2
2230!#1,"2 MULTIPLY $750 BY THE TOTAL NUMBER OF EXEMPTIONS.",%10F2,Z1
2240!#1,"3 TAXABLE INCOME.  SUBTRACT LINE 2 FROM LINE 1....",%10F2,Y0
2250!#1,"4 INCOME TAX FROM SCHEDULE G.....",%10F2,X5
2260!#1," "
2270!#1,"GENERAL TAX CREDIT"
2280!#1," "
2290!#1,"5 ENTER $35 MULTIPLIED BY TOTAL NUMBER OF EXEMP...",%10F2,G1
2300 IF M0$<>"MS" THEN 2380
2310!#1,"6 ENTER AMOUNT FROM LINE 3 ABOVE....."
2320!#1,"7 ENTER ZERO BRACKET AMOUNT....."
2330!#1,"8 SUBTRACT LINE 7 FROM LINE 6....."
2340!#1,"9 ENTER 2 PERCENT OF LINE 8(BUT NOT MORE THEN $180"
2350!#1,"10 GENERAL TAX CREDIT.  LARGER OF LINE 5 OR 9.....",%10F2,G1
2360!#1,"11 TAX.  SUBTRACT LINE 10 FROM LINE 4.....",%10F2,Z6
2370 GOTO 2450
2380!#1,"6 ENTER AMOUNT FROM LINE 3 ABOVE.....",%10F2,Y0
2390!#1,"7 ENTER ZERO BRACKET AMOUNT.....",%10F2,S
2400 Z7= Y0-S
2410!#1,"8 SUBTRACT LINE 7 FROM LINE 6.....",%10F2,Z7
2420!#1,"9 ENTER 2 PERCENT OF LINE 8(BUT NO MORE THEN $180.",%10F2,G2
2430!#1,"10 GEN.  TAX CREDIT.  LARGER OF LINE 5 OR LINE 9....",%10F2,G0
2440!#1,"11 TAX.  SUBTRACT LINE 10 FROM LINE 4.....",%10F2,Z6
2450!#1," "
2460!#1," "
2470!#1," "
2480!#1," "
2490!#1," "
2500 !#1,"                    INCOME AVERAGEING-FORM 1040, SCHEDULE G"
2510 !#1,"                            1977 TAX YEAR"
2520 !#1," "
2530 !#1,"                                ",N$,"  ",N1$
2540 !#1," "
2550 !#1," "
```

```
2560 !#1," (A) (B) (C) (D)"
2570 !#1," 1ST 2ND 3RD 4TH"
2580 !#1," PRECEEDING PRECEEDING PRECEEDING PRECEEDING"
2590 !#1," BASE PERIOD BASE PERIOD BASE PERIOD BASEPERIOD"
2600 !#1," YEAR YEAR YEAR YEAR"
2610 !#1," "
2620 !#1,"1 TAXABLE"
2630 !#1,"  INCOME  ",%10F2,Y1,%13F2,Y2,%13F2,Y3,%13F2,Y4
2640 !#1,"2 INCOME"
2650 !#1,"  EARNED"
2660 !#1,"  OUTSIDE"
2670 !#1,"  U. S.  ",%10F2,U1,%13F2,U2,%13F2,U3,%13F2,U4
2680 !#1,"3 ZERO"
2690 !#1,"  BRACKET ",%10F2,S,%13F2,S,%13F2,S,%13F2,S
2700 O1=Y1+U1+S
2710 O2=Y2+U2+S
2720 O3=Y3+U3+S
2730 O4=Y4+U4+S
2740 !#1,"4 BASE"
2750 !#1,"  PERIOD"
2760 !#1,"  INCOME  ",%10F2,O1,%13F2,O2,%13F2,O3,%13F2,O4
2770 !#1," "
2780 !#1,"COMPUTATION OF AVERAGEABLE INCOME"
2790 !#1," "
2800 !#1,"5 TAXABLE INCOME FOR 1977 FROM SCHEDULE TC..... ",%10F2,Y0
2810 !#1,"6 AMOUNTS SUBJECT TO PENALTY UNDER SEC. 72(M)(5). ",%10F2,Y9
2820 Z=Y0-Y9
2830 !#1,"7 SUBTRACT LINE 6 FROM LINE 5..... ",%10F2,Z
2840 !#1,"8 EXCESS COMMUNITY INCOME..... ",%10F2,Y8
2850 Z1=Z-Y8
2860 !#1,"9 ADJUSTED TAXABLE INCOME(LINE 7 LESS LINE 8).... ",%10F2,Z1
2870 !#1,"10 30% OF THE SUM OF LINE 4, COLUMNS (A) THRU (D)",%10F2,A8
2880 Z5=Z1-A8
2890 !#1,"11 AVERAGEABLE INCOME (LINE 9 LESS LINE 10)..... ",%10F2,Z5
2900 !#1," "
2910 !#1,"     COMPLETE THE REMAINING PARTS OF THIS FORM ONLY IF"
2920 !#1,"     LINE 11 IS MORE THEN $3,000.00."
2930 !#1," "
2940 !#1,"COMPUTATION OF TAX"
2950 !#1," "
2960 !#1,"12 AMOUNT FROM LINE 10..... ",%10F2,A8
2970 Z8=Z5*.2
2980 !#1,"13 20% OF LINE 11..... ",%10F2,Z8
2990 J1=A8+Z8
3000 !#1,"14 TOTAL (ADD LINES 12 AND 13)..... ",%10F2,J1
3010 !#1,"15 EXCESS COMMUNITY INCOME FROM LINE 8..... ",%10F2,Y8
3020 J2=J1+Y8
3030 !#1,"16 TOTAL (ADD LINES 14 AND 15)..... ",%10F2,J2
3040 !#1,"17 TAX ON AMOUNT ON LINE 16..... ",%10F2,V1
3050 !#1,"18 TAX ON AMOUNT ON LINE 14..... ",%10F2,V2
3060 !#1,"19 TAX ON AMOUNT ON LINE 12..... ",%10F2,V8
3070 J5=V2-V8
3080 !#1,"20 SUBTRACT LINE 19 FROM LINE 18..... ",%10F2,J5
3090 !#1,"21 MULTIPLY THE AMOUNT ON LINE 20 BY 4..... ",%10F2,V3
3100 IF Y9=0 THEN 3160
3110 !#1,"22 TAX ON AMOUNT ON LINE 5..... ",%10F2,V4
3120 !#1,"23 TAX ON AMOUNT ON LINE 7..... ",%10F2,V5
3130 K2=V4-V5
3140 !#1,"24 SUBTRACT LINE 23 FROM LINE 22..... ",%10F2,K2
3150 GOTO 3190
3160 !#1,"22 TAX ON AMOUNT ON LINE 5..... "
3170 !#1,"23 TAX ON AMOUNT ON LINE 7..... "
3180 !#1,"24 SUBTRACT LINE 23 FROM LINE 22..... "
3190 K6=V1+V3+K2
3810 IF E3 = 1 THEN 3850
3820 IF E3 = 2 THEN 3870
3830 IF E3 = 0 THEN 3890
3840 IF E3 = 3 THEN 3910
3850!#1," FORM 1040A(1974 AND 1973),LINE 12...  ",%10F2,I3
3860 GOTO  3930
3870!#1," FORM 1040A(1974 AND 1973),LINE 12...                ",%10F2,I4
3880 GOTO 3950
3890!#1," FORM 1040A(1974 AND 1973),LINE 12...  "
3900 GOTO 3970
3910!#1," FORM 1040A(1974 AND 1973),LINE 12...  ",%10F2,I3," ",%10F2,I4
3920 GOTO 3990
3930!#1,"2(A) ENTER 15% OF LINE 1.............  ",%10F2,L3
3940 GOTO 4010
3950!#1,"2(A) ENTER 15% OF LINE 1.............                ",%10F2,L4
3960 GOTO 4030
3970!#1,"2(A) ENTER 15% OF LINE 1.............                "
3980 GOTO 4050
3990!#1,"2(A) ENTER 15% OF LINE 1.............  ",%10F2,L3," ",%10F2,L4
4000 GOTO 4070
4010!#1,"2(B) ENTER $1300(650 IF MS).........  ",%10F2,K3
4020 GOTO4090
4030!#1,"2(B) ENTER $1300(650 IF MS).........                ",%10F2,K4
4040 GOTO4110
4050!#1,"2(B) ENTER $1300(650 IF MS).........                "
4060 GOTO4130
4070!#1,"2(B) ENTER $1300(650 IF MS).........  ",%10F2,K3," ",%10F2,K4
4080 GOTO4150
4090!#1,"2(C) STANDARD DEDUCTION.............  ",%10F2,H3
4100 GOTO 4170
4110!#1,"2(C) STANDARD DEDUCTION.............                ",%10F2,H4
4120 GOTO 4190
4130!#1,"2(C) STANDARD DEDUCTION............."
4140 GOTO 4210
4150!#1,"2(C) STANDARD DEDUCTION.............  ",%10F2,H3," ",%10F2,H4
4160 GOTO 4230
4170!#1,"3 SUBTRACT LINE 2(C) FROM LINE 1.....  ",%10F2,V3
4180 GOTO 4250
4190!#1,"3 SUBTRACT LINE 2(C) FROM LINE 1.....                ",%10F2,V4
4200 GOTO 4270
4210!#1,"3 SUBTRACT LINE 2(C) FROM LINE 1.....  "
4220 GOTO 4290
4230!#1,"3 SUBTRACT LINE 2(C) FROM LINE 1.....  ",%10F2,V3," ",%10F2,V4
4240 GOTO 4310
4250!#1,"4 MULTIPLY TOTAL EXEMPTIONS BY $750..  ",%10F2,D3
4260 GOTO 4330
4270!#1,"4 MULTIPLY TOTAL EXEMPTIONS BY $750..                ",%10F2,D4
4280 GOTO 4350
4290!#1,"4 MULTIPLY TOTAL EXEMPTIONS BY $750..  "
4300 GOTO 4370
4310!#1,"4 MULTIPLY TOTAL EXEMPTIONS BY $750..  ",%10F2,D3," ",%10F2,D4
4320 GOTO 4390
4330!#1,"5 TAXABLE INCOME(LINE 4 LESS 3)......  ",%10F2,C3
4340 GOTO 4400
4350!#1,"5 TAXABLE INCOME(LINE 4 LESS 3)......                ",%10F2,C4
4360 GOTO 4400
4370!#1,"5 TAXABLE INCOME(LINE 4 LESS 3)......  "
4380 GOTO 4400
4390!#1,"5 TAXABLE INCOME(LINE 4 LESS 3)......  ",%10F2,C3," ",%10F2,C4
4400 GOSUB 20
4410 INPUT "DO YOU WANT DIOGNOSTICS:  ",A$
4420 IF A$="N" THEN 5070
4430 IF A$="NO"THEN 5070
4440 !#1," "
```

```
3200 !#1,"25 TAX(ADD LINES 17,21,24) ENTER HERE AND ON TC. .",%10F2,K6
3210 !
3220 IF Y2$<>"Y" THEN 3440
3230 !#1," "
3240 !#1," "
3250 !#1," "
3260 !#1,"COMPUTATIONS ON THIS PAGE ARE NOT REQUIRED UNLESS YOU"
3270!#1,"USED THE OPTIONAL TAX TABLES FOR 1975,1974, OR 1973."
3280!#1," "
3290!#1,"COMPUTATION OF TAXABLE INCOME FOR 1975 IF YOU USED"
3300!#1,"THE OPTIONAL TAX TABLES."
3310!#1," "
3320!#1,"1 ENTER AMT. FROM 1040, LINE 15 OR 1040A, LINE 12.",%10F2,W8
3330!#1,"2(A) ENTER 16% OF LINE 1.....",%10F2,L2
3340!#1,"2(B) ENTER STANDARD DEDUCTION LOWER LIMIT.....",%10F2,B
3350S8=B
3360 IF L2>B THEN S8 = L2
                                                    5T)]. .",%10F2,S8

3370!#1,"2(C) STANDARD DEDUCTION [2(A) OR 2(B) (LARGEST)]. .",%10F2,S8

3380 D2 = D2 * 750 \ S9 = W8 - S8
3390!#1,"3 SUBTRACT LINE 2(C) FROM LINE 1.....",%10F2,S9
3400!#1,"4 MULTIPLY NUMBER OF EXEMPTIONS BY $750.....",%10F2,D2
3410 S9 = S9 - D2
3420!#1,"5 TAXABLE INCOME (SUBTRACT LINE 4 FROM 3).....",%10F2,S9
3430 GOTO 3600
3440!#1," "
3450!#1," "
3460!#1," "
3470!#1,"COMPUTATIONS AN THIS PAGE ARE NOT REQUIRED UNLESS YOU"
3480!#1,"USED THE OPTIONAL TAX TABLES FOR 1975, 1974, OR 1973."
3490!#1," "
3500!#1,"COMPUTATION OF TAXABLE INCOME FOR 1975 IF YOU USED"
3510!#1,"THE OPTIONAL TAX TABLES."
3520!#1," "
3530!#1,"1 ENTER AMT. FROM 1040, LINE 15 OR 1040A, LINE 12."
3540!#1,"2(A) ENTER 16% OF LINE 1....."
3550!#1,"2(B) ENTER STANDARD DEDUCTION LOWER LIMIT....."
3560!#1,"2(C) STANDARD DEDUCTION [2(A) OR 2(B)(LARGEST)]..."
3570!#1,"3 SUBTRACT LINE 2(C) FROM LINE 1....."
3580!#1,"4 MULTIPLY NUMBER OF EXEMPTIONS BY $750....."
3590!#1,"5 TAXABLE INCOME (SUBTRACT LINE 4 FROM 3)....."
3600!#1," "
3610!#1," "
3620!#1," "
3630!#1,"COMPUTATION OF TAXABLE INCOME FOR 1974 AND 1973 IF"
3640!#1,"YOU USED THE OPTIONAL TAX TABLES."
3650!#1," "
3660!#1,"                                          1974        1973"
3670!#1,"ENTER AMOUNT FROM:"
3680 K3= 1300
3690 IF M3$="MS" THEN K3=650
3700 K4 = 1300
3710 IF M4$ ="MS" THEN K3=650
3720 V3= I3 - H3
3730 V4 = I4 - H4
3740 D3= D3 * 750
3750 D4=D4 * 750
3760!#1," FORM 1040(1974 AND 1973),LINE 15"
3770 C3=V3-D3\ C4=V4-D4
3780 IF Y3$="Y" THEN E = 1
3790 IF Y4$="Y" THEN E2=2
3800 E3=E + E2
```

```
4450 !#1," "
4460 !#1,"           ***********DIOGNOSTICS*************"
4470 !#1," "
4480 !#1," "
4490 !#1," "
4500 !#1,"                                1973  1974  1975  1976  1977"
4510 Y1$="NA"
4520 !#1," "
4530 Y0$="NA"
4540 !#1,"TAX TABLES USED                  ",Y4$,"     ",Y3$,"     ",Y2$,
4550 !#1,"    ",Y1$,"     ",Y0$

4560 !#1," "
4570 D4=D4/750
4580 D3=D3/750
4590 D2=D2/750
4600 D4$="NA"
4610 D3$="NA"
4620 D2$="NA"
4630 IF Y4$="Y" THEN A=1
4640 IF Y3$="Y" THEN A=2+A
4650 IF Y2$="Y" THEN A=4+A
4660 IF A=0 THEN 4740
4670 IF A=1 THEN 4770
4680 IF A=2 THEN 4800
4690 IF A=3 THEN 4830
4700 IF A=4 THEN 4860
4710 IF A=6 THEN 4890
4720 IF A=5 THEN 4920
4730 IF A=7 THEN 4950
4740 !#1,"NUMBER OF DEPENDENTS          ",D4$,"     ",D3$,"     ",D3$,
4750 !#1,"    ",Y1$,"     ",D0
4760 GOTO 5010
4770 !#1,"NUMBER OF DEPENDENTS          ",%2I,D4 ,"     ",D3$,"     ",D2$,
4780 !#1,"    ",Y1$,"     ",D0
4790 GOTO 5010
4800 !#1,"NUMBER OF DEPENDENTS          ",D4$,"     ",%2I,D3  ,"     ",D2$,
4810 !#1,"    ",Y1$,"     ",D0
4820 GOTO 5010
4830 !#1,"NUMBER OF DEPENDENTS          ",%2I,D4,"     ",%2I,D3,"     ",D2$
4840 !#1,"    ",Y1$,"     ",D0
4850 GOTO 5010
4860 !#1,"NUMBER OF DEPENDENTS          ",D4$,"     ",D3$ ,"     ",%2I,D2 ,
4870 !#1,"    ",Y1$,"     ",D0
4880 GOTO 5010
4890 !#1,"NUMBER OF DEPENDENT           ",D4$,"     ",%2I,D3  ,"     ",%2I,D2
4900 !#1,"    ",Y1$,"     ",D0
4910 GOTO 5010
4920 !#1,"NUMBER OF DEPENDENTS          ",%2I,D4 ,"     ",D3$ ,"     ",%2I,D2
4930 !#1,"    ",Y1$,"     ",D0
4940 GOTO 5010
,
4960 !#1,"    ",Y1$,"     ",D0
4970 IF M4$(2,2)<>"S" THEN M4$(2,2)=" "
4980 IF M3$(2,2)<>"S" THEN M3$(2,2)=" "
4990 IF M2$(2,2)<>"S" THEN M2$(2,2)=" "
5000 IF M0$(2,2)<>"S" THEN M0$(2,2)=" "
5010 !#1," "
5020 IF Y4$="N" THEN M4$="NA"
5030 IF Y3$="N" THEN M3$="NA"
5040 IF Y2$="N" THEN M2$="NA"
5050 !#1,"FILLING STATUS FOR YEAR       ",M4$,"     ",M3$,"     ",M2$,
5060 !#1,"    ",Y1$,"     ",M0$
5070 !#1,"*************************************END**********************"
```

Manufacturing Operations Planning With A Programmable Calculator

By C. R. Carpenter

Programmable calculators have become as indispensable in business as the small computer. And for the small business they can be the small computer for many calculation tasks. The task to be described will determine the number of direct people needed to produce a product each month.

Estimates of direct manpower needed to build a quantity of product during any production month can be calculated from the following relationships:

- machines × hours/machine × machine hedge % ÷ operating factors = equivalent hours
- work days/month × 8 hours/day = available production hours
- equivalent hours ÷ available production hours = equivalent direct labor

Reduced to "calculatorese," the equations look like this:

(RCL 1 × RCL 2 × RCL 3) ÷ RCL 4 = (equiv. hrs.)

RCL 5 × 8 = (avail. hrs.)

RCL 6 ÷ RCL 7 = (equiv. heads)

Where: RCL 1 = machines/month
RCL 2 = hours/machine
RCL 3 = machine hedge %
RCL 4 = operating factor
RCL 5 = work days/month
RCL 6 = equivalent hours
RCL 7 = hours/month

A program to crunch many sets of numbers can now be written from this table. (For a TI Programmable 57 in this case.) Such a program is shown in Figures 1 and 2. This program assumes that all learning is stable and production is essentially continuous.

Machine hedge is for units required in addition to schedule. Internal use and spare parts are examples.

Operating factors for this calculation include: attendance percent, utilization percent and efficiency percent. In a measured daywork environment these values might be as follows:

- attendance 95% or .95
- utilization 90% or .90
- efficiency 85% or .85

All these factors affect the number of people actually needed to complete a given amount of work in a given amount of time. Therefore, the operating factor becomes:

(.95 × .90 × .85) = .73 (rounded)

for this example.

Following is a sample run listing using the calculator program.

- units to be built = 100
- hours to build each unit = 7
- machine hedge = 1.05
- factors = .73
- work days = 20

Enter the data as described in the "how to use it" section of Figure 1. The values obtained will be: 1006.85 equivalent hours 160 hours/month and 6.29 direct people. More than likely, 6 people will be used with overtime making up the .29 difference.

Any particular calculations would be adjusted according to the way the manufacturing environment affects each factor. In a start-up or a start/stop situation, the hours/machine are modified by learning and progress function calculations. But that's a subject by itself.□

PROGRAM TITLE/PURPOSE ESTIMATE OF DIRECT MANPOWER
PROGRAMMER C. R. (CHUCK) CARPENTER
DATE 16 JAN 1978

TI PROGRAMMABLE 57
PROGRAM RECORD

PROGRAM DESCRIPTION

CALCULATES:
- EQUIVALENT HOURS NEEDED TO PRODUCE 'N' MACHINES
- AVAILABLE PRODUCTION HOURS PER MONTH
- EQUIVALENT DIRECT LABOR NEEDED TO PRODUCE 'N' MACHINES

(DETERMINE INDIRECT AS A RATIO TO DIRECT: I.E, 10% ADDITIONAL FOR MATERIAL HANDLERS AND 10% ADDITIONAL FOR INSPECTION.)

HOW TO USE IT:

STEP	PRESS RST	DISPLAY/COMMENTS
1	ENTER - MACHINES/MO.	
2	R/S	DATA IN REGISTER 1
3	ENTER - HOURS/MACHINE	
4	R/S	DATA IN REG. 2
5	ENTER - MACHINE HEDGE %	1.05 = 5% HEDGE
6	R/S	DATA IN REG. 3
7	ENTER - OPERATING FACTOR	ATT. UTIL. EFF. (.73)
8	R/S	DATA IN REG. 4
9	ENTER - WORK DAYS/MO	
10	R/S	DATA IN REG. 5
11	R/S	SEE: EQUIVALENT HRS.
12	R/S	SEE: AVAILABLE HOURS
13	R/S	SEE: EQUIVALENT DIRECTS
14	GTO 1, OR 2, OR 3	REVIEW DATA IN STEPS 11,
15	PRESS RST TO START AGAIN	OR 12, OR 13

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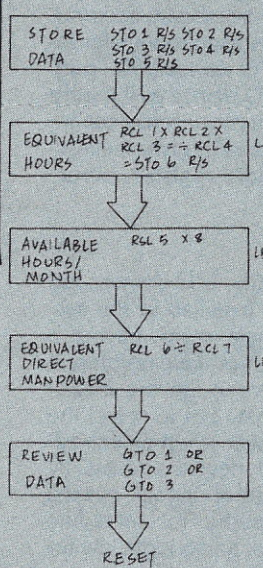
Figure 1.

FLOW CHART/NOTES



MEMORIES			LABELS
0	■	n	0
1		Σy	1 EQUIV. HRS.
2		Σy	2 HOURS/MO.
3		Σx	3 EQUIV. DIRECTS
4		Σx	4
5	(AOS)	Σxy	5
6	(AOS)		6
7	(t)		7
			8
			9

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0 0 1

KEY	LOC	CODE	COMMENTS
STO 1	00	32 1	MACH/MO
R/S	01	81	
STO 2	02	32 2	HRS./MACH
R/S	03	81	
STO 3	04	32 3	MACH HDG.
R/S	05	81	
STO 4	06	32 4	OPER. FAC.
R/S	07	81	
STO 5	08	32 5	WORK DAYS
R/S	09	81	
2ND LBL 1	10	86 1	
RCL 1	11	33 1	
X	12	55	
RCL 2	13	33 2	
X	14	55	
RCL 3	15	33 3	
=	16	85	
÷	17	45	
RCL 4	18	33 4	
=	19	85	
STO 6	20	32 6	EQUIV. HRS.
R/S	21	81	
2ND LBL 2	22	86 2	
RCL 5	23	33 5	
X	24	55	
8	25	08	
=	26	85	
STO 7	27	32 7	AVAIL. HRS.
R/S	28	81	
2ND LBL 3	29	86 3	
RCL 6	30	33 6	
÷	31	45	
RCL 7	32	33 7	
=	33	85	
R/S	34	81	EQUIV. DIR.
LRN	35		
2ND FIX 2	36		
	37		
	38		
	39		
	40		
	41		
	42		
	43		
	44		
	45		
	46		
	47		
	48		
	49		

Figure 2.

Programming Technique Night 3

By Bill Turner, Senior Editor Southeastern Region

Before an understanding of programming can be achieved, how input and output takes place must first be understood. This is necessary because you can't add, subtract, or move data around in a computer until you can get the information into the machine. Furthermore, you can't display what the end result of the computations are unless you can output the data. Therefore, it is important to learn how to get data in and out of the machine. That is, how to perform I/O.

I/O TECHNIQUES

Microcomputers will generally use one of two different techniques for handling I/O. The first of these techniques is to provide two special purpose instructions: one to transfer information from the I/O device to the microprocessors accumulator (INput) and the second instruction is used to transfer information from the accumulator to the I/O device (OUTput).

The second technique is to treat the I/O device as if it were a memory location. In this mode, any memory reference instruction can be used to perform I/O. Load register instructions become "INput" requests, and Store register instructions become "OUTput" requests.

DEVICE MAPPED I/O

The 8085, as in the entire 8080 family, I/O devices are generally given a *device address* when installed in the system. This device address is a single byte code, having a hexadecimal value of 00 to FF. These values have nothing in common with memory addresses, even though the microprocessor uses the 16-bit memory address but to select the proper I/O device. (The hardware knows whether the address is a memory address or an I/O device address by checking the current status of a control signal passed through the system bus called. The Memory/IO status line will be a logic high for a memory address, and a logic low for an I/O device address.)*

The **IN** and **OUT** instructions in the 8085 are two byte instructions. The first byte identifies the operation as either INput or OUTput, the second byte identifies the device address.

INput and OUTput requests made using the IN and OUT instructions of the 8085 also require the use of the A-register. This must be kept in mind when designing software for a specific application.

MEMORY MAPPED I/O

The 6800 requires a memory mapped I/O technique. This is because the 6800 does not support a special input or output instruction set.

*The 8085 may use memory mapped I/O if desired. In fact, D.C. Hayes and other manufacturers of plug-in boards for the popular S-100 bus, design their equipment so that the user can select either I/O device mapping or memory mapping.

The basic concept behind memory mapped I/O is that as long as the I/O device responds like a memory device, the processor can't tell the difference. The advantage of using memory mapped I/O is that you have a larger instruction set to work from. Instead of only being able to transfer one byte at a time between the I/O port and the accumulator, you can now perform logical and arithmetic type operations on the port data, as well as use all the registers for data transfer. Therefore, under the right conditions it is even possible to transfer 16 bits at a time. Table 1 provides some new meanings to instructions in the 8085, and Table 2 for the 6800. See if you can discover any that I have left out.

Table 1. 8080 Memory Mapped I/O Instructions

MOV	r,M	input port to any register
MOV	M,r	output any register to port
MVI	M, . .	output immediate data to port
LDA	. . .	input port to accumulator (functionally the same as "IN")
STA	. . .	output accumulator to port (functionally the same as "OUT")
LHLD	. . .	16 bit input
SHLD	. . .	16 bit output
ADD	M	add port data to accumulator
ANA	M	"and" port data with accumulator

NOTE: Dots (. . .) indicate operand

Table 2. 6800 Memory Mapped I/O Instructions

LDAA	. . . .	input port data to a-register
STAA	. . . .	output a-register to port
ANDA	. . . .	"and" port data with register
ORAA	. . . .	"or" port data and register
XORA	. . . .	"exclusive or" port and register
LDX	. . . .	input 16-bit data
STX	. . . .	output 16-bit data
CLR	. . . .	clear the data port
ROR	. . . .	rotate the port data right one bit
ROL	. . . .	rotate the port data left one bit
TST	. . . .	test the port data for +,-, zero

NOTE 1: These instructions could also reference the B-register
NOTE 2: Dots (. . .) indicate operand

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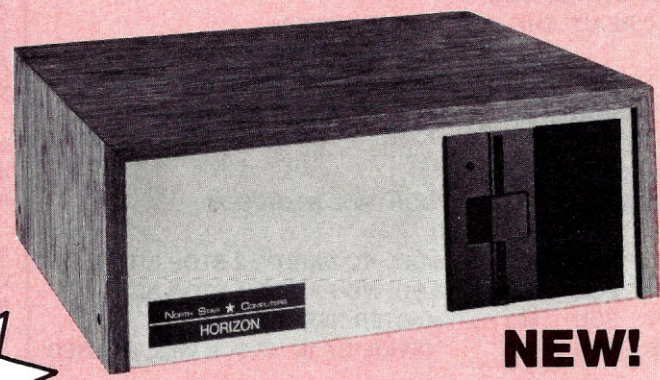

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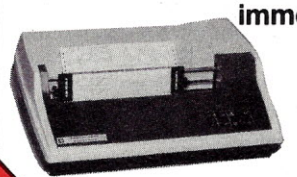

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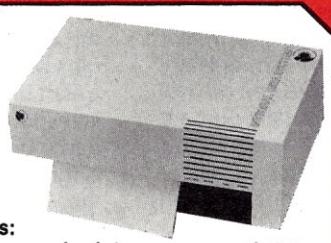

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Table 3. 6800 Equate Statements

```
* ACIA STATUS BITS:
*     ("READ" THE CONTROL REGISTER)
*
XMIT    EQU   $02     XMIT READY STATUS BIT IN THE ACIA
RCV     EQU   $01     RECV READY STATUS BIT IN THE ACIA
*
* ACIA CONTROL BITS:
*     ("WRITE" INTO THE CONTROL REGISTER)
*
B110    EQU   $10     8-BIT, NO PARITY, 2 STOP BITS
B300    EQU   $14     8-BIT, NO PARITY, 1 STOP BIT
RESET   EQU   $03     MASTER RESET
CLK16   EQU   $01     "DIVIDE BY 16" CLOCK WILL BE USED
*
* PORT ADDRESSES:  (MEMORY MAPPED I/O)
*
PORTC   EQU   $8000   ADDRESS OF CONTROL REGISTER
PORTD   EQU   $8001   ADDRESS OF DATA REGISTER
```

From the tables you can see there are many advantages to using memory mapped I/O, particularly in the flexibility of being able to use a larger instruction set for I/O.

However, there are disadvantages because the I/O system now occupies *memory space,* leaving less real memory available to the user. Unfortunately, some microcomputer designers have elected to use the high-order memory address bit, (bit 15), to segregate memory addresses and I/O addresses, thus limiting system memory to 32K or less.

Also for the 8085 there is a disadvantage to using memory mapped I/O — it could be a hair slower. If you were to use the LDA or STA instructions in the 8085 you would find that it requires 13 clock cycles and the IN and OUT would only require 10 clock cycles. However, if you are reading in ASCII data and always masking off the high-order bit (ignoring parity) as is the usual custom, you may find that you can do it slightly faster when using memory mapped I/O. Think about it . . .

Regardless of which hardware technique is used, the data usually winds up in one of the system registers. The major question then is: how do we actually get it into the register?

When you input or output data to an I/O port, you are not really talking directly to the remote device. Usually you are communicating with either an *asynchronous communications interface adapter* (ACIA), or a *parallel interface adapter* (PIA). This month we will discuss the ACIA and next month the PIA.

Because of its popularity, I will use the Motorola MC6850 asynchronous communications interface adapter as a typical ACIA. ACIAs can also be called UARTs (Universal Asynchronous Receiver/Transmitter).

The MC6850 ACIA provides a means for interfacing microcomputers to devices requiring an asynchronous serial data format. The MC6850 includes features for formatting and controlling such peripherals as Modems, CRT terminals, and printing terminals. ASYNC communications may also be used for CPU to CPU transmissions through the use of appropriate protocols, such as ™.

The MC6850 has four internal registers that can be accessed by reading or writing two different memory or device addresses. The first address is used as a *control* address, while the second is used as a *data* address. You may change the internal operation of the ACIA by writing a new control byte to the control address, and you may also check the internal status by reading a byte from the control address. The ACIA always appears to the MPU as a *normal* memory location for memory mapped I/O. Data transfers, through the ACIA, take place after the controlling software checks the appropriate control register status bit of the ACIA.

An ASYNC message is sent serially character by character and each character is sent serially bit by bit. Also, each character is preceded by a bit set to zero, called a *start bit,* and is terminated by one or two bits set to a one, called *stop bits.*

The transmission speed determines whether there are one or two stop bits. ASYNC transmissions of 110 baud (10 characters per second), are sent with two stop bits. ASYNC transmissions of any speed greater than 110 baud are sent with one stop bit. Therefore, 300 baud (30 characters per second) and 1200 baud (120 characters per second) are sent with one stop bit.

Generally the byte (8 bits) that was stored in memory is transmitted *as is* to the communication line (Figure 1).

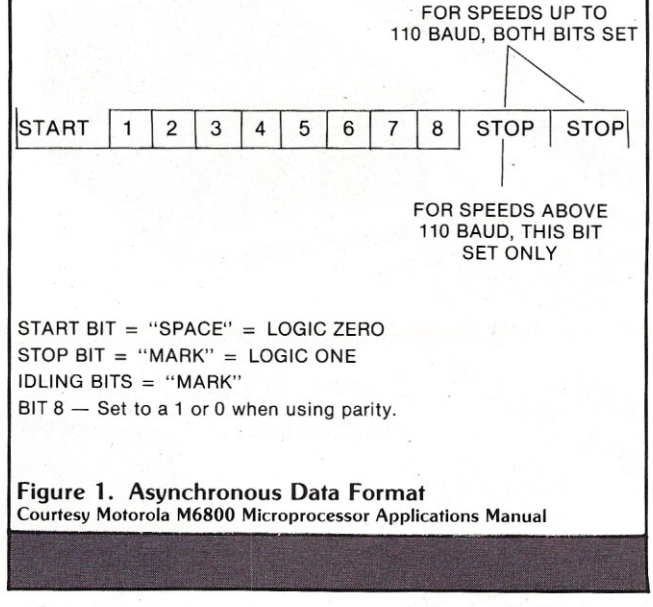

Figure 1. Asynchronous Data Format
Courtesy Motorola M6800 Microprocessor Applications Manual

Occasionally, it is necessary to transmit the ASCII character with a specified Even or Odd parity. When this occurs, the ACIA or UART is usually programmed to transmit 7-bits plus parity. This still adds up to a character that is made up of a start bit, 8 data bits, and 1 or 2 stop bits. The ACIA/UART is responsible for calculating and transmitting the appropriate parity bit value. When transmitting parity, the high order bit is ignored, but the lower 7 bits are transmitted as is. For a further description on ASCII, see "Inside Ascii," INTERFACE AGE May, June and July, 1978 by R.W. Bemer.

The UART or ACIA is a fairly complex device which must be told exactly what to do. This will include items like the number of bits in each character, what kind of parity is to be set, are interrupts going to be used? It may also include telling the ACIA how fast the clock pulses are. This process is called initializing and it must be done. Some hardware designs may automatically initialize the ACIA, but normally this is done by software. It is also possible that your system monitor may go out and automatically initialize all your I/O ports. The important thing is that it must be done prior to any attempt to read or write data.

Now there are some standard initialization sequences that should be used. Examples 1 and 2 are some sample 6800 and 8085 codes to initialize a Motorola 6850 ACIA.

```
INIT    LDAA   OESET + B110
        STAA   PORTC          RESET THE ACIA
        LDAA   13LOCK + B300  SET UP FOR 300 BAUD
        STAA   PORTC          ACIA NOW PROPERLY SET UP
        RTS
```

NOTE: See Table 3 for definitions of labels

Example 1. 6800 ACIA Initialization

```
        OUT    PORTC          RESET THE ACIA
        MVI    A,CLOCK + B300
        OUT    PORTC
        RET
```

NOTE: See Table 4 for definitions of labels.

Example 2. 8085 ACIA Initialization

READING DATA

Now that the ACIA has been initialized, we may proceed to read data from it. Since the microcomputer is many times faster than the remote terminal, we must have some method for the MPU to check the status of the UART and determine if there is a new data byte ready to be read. If you did not first check this status, then it might be possible for you to read a single keystroke many hundreds of times, giving the impression that the keyboard operator is holding down a very fast repeat key.

Examples 3 and 4 demonstrate one technique of reading the status of the ACIA continuously, until a character is finally available. At this time it reads the data byte in and returns back to the caller of this INput subroutine.

```
READ    LDAA   PORTC  GET PORT STATUS
        ANDA   OCV    MASK OFF ALL BUT RCVR STATUS
        BEQ    READ   IF REGISTER ZERO, KEEP LOOPING
*
* REGISTER NOT ZERO, DATA NOW READY FOR READING
*
        LDAA   PORTD  GET THE DATA BYTE
        RTS
```

NOTE: See Table 3 for definitions of labels

Example 3. Read Routine for the 6800

```
READ    PUSH   PSW    SAVE THE CURRENT VALUE OF
                      THE A-REGISTER
READ1   IN     PORTC  GET THE PORT STATUS
        ANI    RCV    MASK OFF ALL BUT RCVR STATUS
        JZ     READ1  LOOP UNTIL DATA BYTE AVAILABLE
*
* STATUS SEZ THERE IS A CHARACTER READY. . .
*
        IN     PORTD  GET THE DATA BYTE
        MOV    C,A    RETURN THE DATA BYTE IN
                      THE C-REGISTER
        PULL   PSW    RESTORE THE A-REGISTER TO ITS
                      ORIGINAL VALUE
*
        RET
```

NOTE: See Table 4 for definitions of labels

Example 4. Read Routine for the 8085

Examples 5 and 6 illustrate an echo program. This is where as a character is received, it is immediately sent back out on the same or a different port — echoing all characters received.

```
START   JSR    INIT   INITIALIZE THE PORT
INPUT   JSR    READ   GET A DATA BYTE
        JSR    WRITE  AND OUTPUT IT
        JMP    INPUT  AND GO GET ANOTHER. . .
```

NOTE: See Table 3 for definitions of labels

Example 5. 6800 Echo Program

```
START   CALL   INIT   INITIALIZE THE PORT
INPUT   CALL   READ   GET A DATA BYTE
        CALL   WRITE  AND OUTPUT IT
        CALL   INPUT  AND GO GET ANOTHER. . .
```

NOTE: See Table 4 for definitions of labels

Example 6. 8085 Echo Program

NEXT MONTH

The discussion on how you input data through a serial port will be completed. In addition, we will discuss inputting data through a parallel port and the concept of buffering. We will also discuss the concept of command lookup tables.□

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National Technical Schools Mini-Series of Basic Electronics Unit 2

By Walter L. Stephens
Assistant Chief Instructor
National Technical Schools, Los Angeles, California

In our previous tutorials we discussed the basic fundamentals of electricity and electronics, since these principles are common to all fields of electronics, including computers and automation devices. With this tutorial we begin an initial study of computer organization.

TABLE OF CONTENTS

INTRODUCTION TO COMPUTER TECHNOLOGY

The electronic computer might simply be defined as: an electronic machine, which by means of stored instructions can rapidly process information, control work functions and at the same time produce the results of these two operations.

The development and continuous improvement of computing machines has come about as a consequence of the increasing necessity to reduce the time required for solving mathematical, data processing and industrial problems.

In science and engineering, as well as in the business world, the complexity of the variables involved is so great that a large number of numerical calculations, actions and operations must be performed in order to solve the many problems encountered in these fields. It is true that some of these problems could be solved by normal time-consuming mathematical or clerical operation; however, by employing computing machines they can be solved more quickly. In some cases, as in meteorological forecasting for example, it is of absolute necessity to employ a rapid means of computation, because if the computation time is excessive, the answer is no longer of value.

By the same token, competition in industry forces manufacturers to be cost conscious. One way to reduce production costs is to manufacture the product with automatic equipment (automation). The control and decision circuits necessary for operating machines automatically are computer systems.

MAIN CLASSES OF COMPUTERS

Fundamentally, there are two computing principles that are utilized in the field of computation. These two principles (systems) are referred to as *analog* and *digital.* Although the digital machine predominates in the field of computation, it is only logical that we try to define both principles at this time.

A digit is defined as any numeral 0 to 9; so called, because, originally man counted on fingers. Digital defined as an adverb: "of or constituting a digit," however digital defined as a noun means "finger." Fundamentally the digital system breaks down into a 10 finger counting method. The digital system therefore utilizes digits that are representative of discrete numbers. (The binary numbering system which is used in digital computers will be presented in Unit Four.) In other words, in this system, *discrete quantities* are counted.

The adjective term analog is derived from the word analogous, which means: 1. similar or comparable in certain respects; 2. similar in function but not in origin and structure. In an electronic analog system an analogy of a problem (fluid, air, etc.) is set up with electrical circuits, then an electrical quantity (voltage, current, etc.) is continuously monitored (measured) that is analogous to a physical quantity (pressure, rate of flow, etc.) in the original problem.

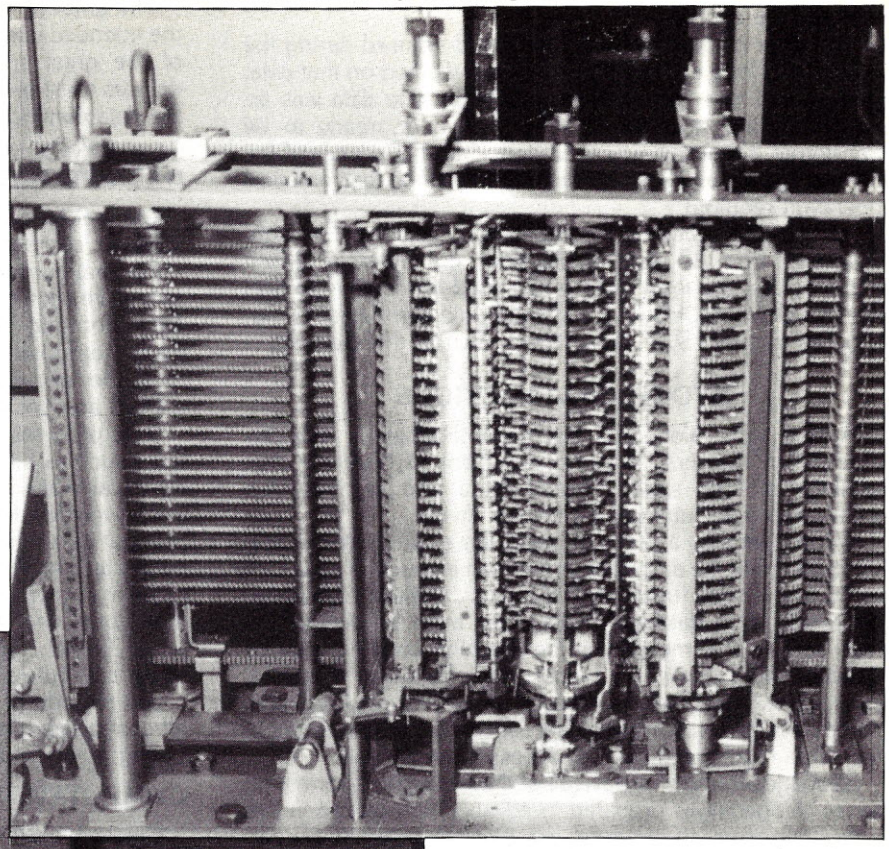
Analog systems deal in real time, while digital systems do not necessarily have to. An example of an analog device is the mercury column thermometer; the rise and fall of the mercury inside the column is analogous to the rise and fall of

temperature. The conventional voltmeter (or current meter) and the automobile speedometer are other examples.

Analog computing is not nearly as accurate as the digital system because it is limited by component tolerance and the accuracy limits of measurement. Digital accuracy (for all practical purposes) is virtually unlimited. Since our real world is more analog by nature, we quite frequently have to change a physical happening into digital, (analog to digital conversion), process it in digital, then change the processed data back into analog (digital to analog conversion). (Process conversion will be discussed in a future tutorial.)

Analog computers are not extinct, but for some time the digital computer has dominated the field. The emphasis on the use of digital machines has been further enhanced since the advent of the microprocessor. This series of tutorials will concentrate on digital principles and computers.

PHOTO 1 Babbage Analytical Engine. Photo courtesy of California Museum of Science and Industry, Los Angeles.



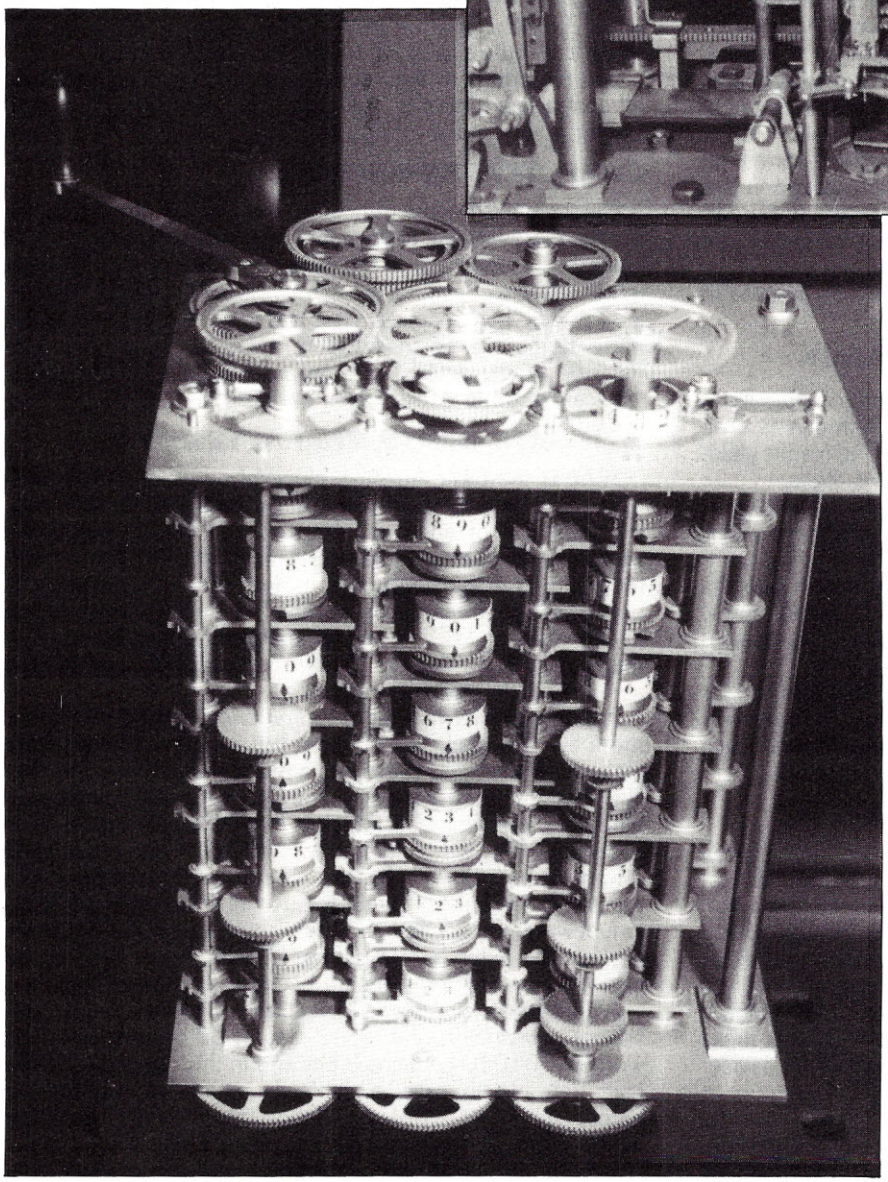


PHOTO 2 Babbage Differential Machine. Photo courtesy of California Museum of Science and Industry, Los Angeles.

THE BABBAGE MACHINE

This month the fundamentals of electronic digital computers will be described. However, so their principle of operation is more easily understood, an early mechanical computer will be described.

Charles Babbage, a professor of mathematics at Cambridge University in the 1830's, attempted to build an automatic mechanical calculators 50 years before the adding machine was invented. He produced a machine which became known as "Babbage's Folly." However, the ideas he incorporated in the design of his machine were recorded, and they have provided some of the basic principles used in modern electronic computers.

Babbage visualized a machine that was able to complete an operation of addition in one second. It was to be mostly automatic and not dependent upon the action of an operator, since speed would be lost if the machine had to stop after every operation and wait for an operator to make each entry of data.

To attain the speed required, the entry of data as well as the computing had to be accelerated. Babbage had to incorporate in his machine both the function of the work sheet (which is the store of data) and the function of the operator who enters it. Furthermore, data had to be stored in a form that could be fed quickly and mechanically into the machine whenever it was required.

PARTS OF THE MACHINE

Babbage's machine consisted of three parts, the store, the mill and the control.

The store held all the data that would be used during the course of a long computation. The mill worked on that data. The control was the automatic operator. The data was arranged in the store in an orderly manner, ready to be transferred to the mill when needed. The mill contained the arithmetic unit; a unit which was to perform the mathematical operation required.

As the mill finished each computation, the control brought more data from the store. In electronic computers of British manufacture, the term store is still used to identify the data storage elements. However, in electronic computers manufactured in the U.S.A. this unit is known as the memory.

STORED INSTRUCTIONS

A data store alone did not make Babbage's machine automatic. That is, it was not sufficient to have the data available at high speed; the machine also had to know whether to add, subtract, multiply or divide.

When operating a desk calculator, for example, the operator first keys in the data, then presses an instruction key, such as the key labeled "multiply." However, to attain high speed operation, both data and instructions must be available at high speed. This means that the machine must have an instruction store as well as a data store. Babbage, therefore, provided two such separate stores. In present-day electronic computers, instructions and data are generally both stored in the same high speed random-access memory unit.

Babbage arranged to have all of the instructions for a long series of operations prepared in advance and placed in this instruction store, in the order in which they were to be performed. Thus, whenever the mill finished one operation, the instruction store would supply the next one.

Let us now see how these basic ideas are incorporated in modern electronic computers.

DIGITAL COMPUTER OPERATION

Digital computers, as the name implies, perform operations with data expressed in the form of digits which can assume only separate or individually distinct values. The results yielded by such a computer are also expressed in digits.

The overall complexity of digital computing equipment is attributable to the large number of circuits required to perform the necessary functions, and not to any inherent complexity of the individual circuits. Furthermore, although the equipment may contain a large number of components, there is much repetition involving only a few basic integrated circuits (ICs).

An understanding of digital techniques, therefore, grows from an understanding of logic circuits, and of a relatively few ICs and circuit configurations used to implement these logic circuits.

ELECTRONIC DIGITAL COMPUTERS

The electronic computer, as Babbage's machine, has a memory (store). In order to feed and obtain information, input and output devices are also incorporated in the computer.

The input and output devices are the links through which the computer communicates with the personnel who operate it. It is through the input devices that the computer receives the data upon which it operates and the instructions telling it what types of operations to perform. The end result of these operations is then communicated through the output device.

PERIPHERAL EQUIPMENT

Electric typewriters, punched paper tape, punched cards, magnetic tape and video display (cathode-ray tube) terminals are frequently used as input-output devices. These units are classified as peripheral equipment, as distinguished from the computer proper, which is referred to as the central computer or central processing unit (CPU.)

The amount of peripheral equipment required varies with the intended use of the computer. In order to take advantage of the great speed of the computer, these input-output devices must permit the rapid introduction in the memory of the data coming from the program.

SCIENTIFIC AND DATA-PROCESSING COMPUTERS

General-purpose digital computers can be used as (a) scientific computers or (b) data-processing systems.

General-purpose computers arranged as scientific computers are used primarily for mathematical computations and for performing lengthy calculations on relatively little data. Such computers are therefore provided with high speed memories and elaborate arithmetic circuitry, but require only a small amount of peripheral equipment.

Data processing equipment is used for business applications such as billing, payroll preparation, inventory control, statistical analysis, etc. These computers are used to perform a relatively few types of calculations on a very large amount of input data. As might be expected, general-purpose computers arranged for data processing are provided with large amount of memory and input-output equipment. Some time ago, computers were classified as small, medium and large (main frame). Now we have micro, mini, small large and super computers, according to their size and price.

But regardless of their size, the principles of operation of all computers is similar, the main difference being the computing power of the computer.

COMPUTER TERMINOLOGY

Before analyzing the principles of operation of digital computers, it is advisable to first clarify certain terms employed in electronic computers. In the study of digital computers, frequent reference is made to such terms as bits, digits, characters, words, bytes, access time and many others. Although these terms are borrowed from everyday language, they must be rigidly defined for computer usage. Misinterpretation can result in considerable confusion.

BITS, DIGITS, CHARACTERS, ETC.

A *bit* is the basic building block of any digital system. It represents an individual piece of information; for example, the presence of absence of a voltage level, a pulse, the presence or absence of magnetization, etc. The piece of information is either there or it is not there. Its presence is usually assigned the binary number "1" and its absence the binary number "0". In digital computers, bits are used in many ways, but always in combination to convey information about multiple-possibility situations.

In computer terminology, a *digit* is comprised on one or more bits. It usually is a number, but it can be a letter of the alphabet when used to express a number such as in the hexadecimal numbering system. The digit can have many possible forms, unlike the bit, which is limited to two (presence or absence). The words *character* and *digit* are often used synonymously, but a character is normally associated with one symbol of a set of symbols, such as those corresponding to typewriter keys. The number 6 is both a digit and a character, but the letter M is a character only. Thus, we see the possibility of problems arising because of word definition.

A computer *word* is one logical unit of information. It consists of combinatins of 4, 8, 12, 16, or 32 or more bits. The word 10101010 contains 8 bits and in this case it is called a *byte.* Four bits are called a nibble. There are no other specific names for other word sizes; but words which combine numbers and letters are called "alphanumeric words."

Access time is the time it takes a computer to locate data or an instruction word in its memory or storage section, and transfer it to its arithmetic unit where the required computa-

tions are performed. Also, it is the time it takes to transfer information which has been operated on, from the arithmetic unit to the location in the memory where the information is to be stored.

FUNDAMENTAL SECTIONS OF A DIGITAL COMPUTER

Since the differences between large, general-purpose computers, and mini and microcomputers is more quantitative than qualitative, we will not use any particular computer as the basis for this analysis. Note in Figure 36 that every computer can be considered to be made up of four basic units: 1. the input/output unit; 2. the memory; 3. the arithmetic logic unit (ALU) and 4. the control unit.

direct the activities of central processing unit (CPU) of the computer. Data is the information to be processed by the CPU. A group of logically related instructions, stored in memory, is referred to as a *program*. The CPU reads each instruction from memory in a logically determined sequence and uses it to initiate processing actions. If the program sequence is properly organized, processing the program will produce intelligible and useful results.

Since memory is used to store the data, as well as the instructions that direct manipulation of the data, the program must be organized in such a way that the CPU does not read a non-instruction word when it expects to see an instruction.

Besides instructions and data, the partial results of operations being performed by the arithmetic unit can also be

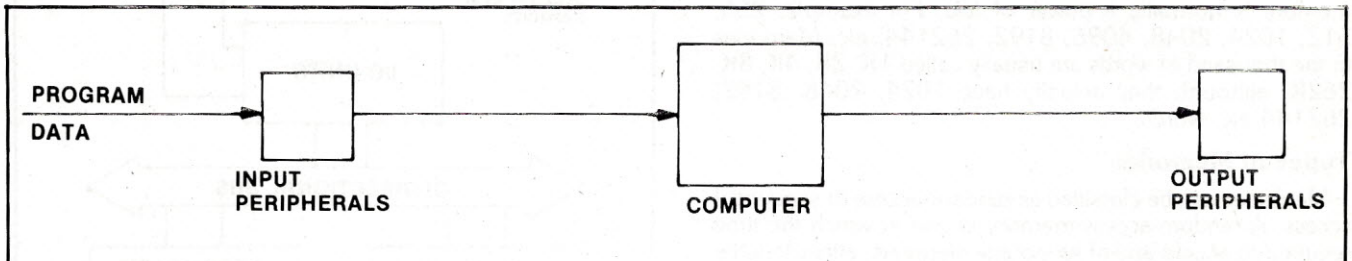


Figure 35. Oversimplified system diagram.

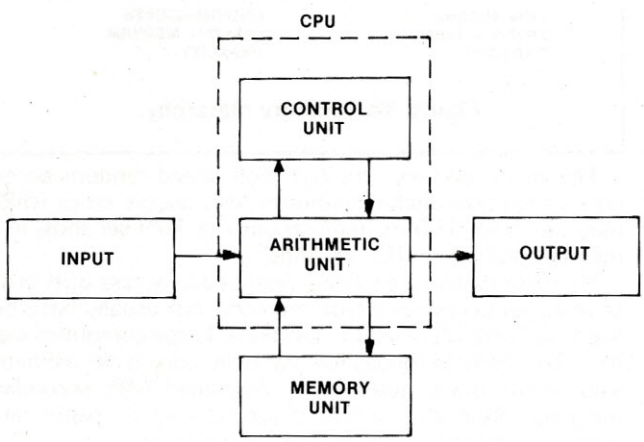


Figure 36. Four basic units of a computer.

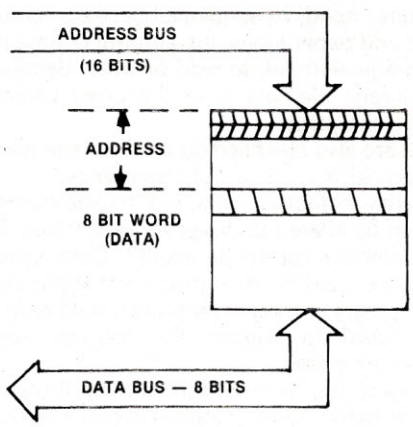


Figure 37. Organization of a memory.

INPUT

The input is the means by which data is introduced into the computer. There are many types of input devices varying from toggle switches to optical bank check readers.

Some complex input devices perform some of the operations normally assigned to the computer. For example, many keyboards convert their key closures to pre-defined codes, liberating the computer from this task so that it is free for other tasks.

OUTPUT

Output devices transfer processed data from the computer to the outside world. The output can be for the computer operator's use, as that obtained from video (CRT) terminals, printers, etc., or this output can serve to control or activate other equipment. It is important that even though they are technically considered storage devices, magnetic disks, tapes and other similar devices are also often said to be output devices.

MEMORY

The memory serves as a place to store instructions and data. Instructions are the coded pieces of information that stored. These partial solutions are kept in storage while other operations are being performed, ready to be retrieved from memory when needed to continue with the computation. The memory also stores the final solution to the problem so that it may be transferred to the output device.

Memory Organization

A memory is logically organized in words. As mentioned, a word is one logical unit of information, consisting of 4, 8, or 16 bits in microcomputers, 12, 16, 18 and 24 bits in minicomputers, and 24, 32 and even 64 bits in large computers.

An 8-bit microprocessor requires 8 bits of data, and the word size for an 8-bit microprocessor is therefore 8 bits. Thus, its memory is structured in 8-bit words.

The organization of typical memory is shown in Figure 37. The length of the memory is its number of bits (word size). Bits are normally numbered from 0 to n. In the case of an 8-bit word, the position of the bit within the memory will, therefore, be referenced by a digit from 0 to 6, as shown in Figure 38. Vertically, the height of memory is its capacity, or number or words that can be stored in the memory.

BITS							
7	6	5	4	3	2	1	0
1	0	1	1	0	1	1	0

Figure 38. Bits are numbered from 0 to 7 in an 8-bit word.

The location of the word within the memory is called its *address*. The first word of the memory has address 0, the next address 1, and so on. For decoding reasons the size of the memory is normally a power of two. For example: 256, 512, 1024, 2048, 4096, 8192, 262144, etc. Memories in the thousand of words are usually called 1K, 2K, 4K, 8K, 262K, although they actually have 1024, 2048, 8192, 262144 etc. words.

Types of Memories

Memories can be classified as random-access or sequential access. A random-access-memory is one in which the time required to access any of its storage elements, either to write into it, or to read from it, is the same for all elements. Among this type of memory are: Magnetic core memories, semiconductor read/write memories and semiconductor read-only memories (ROM).

On the other hand, in sequential access memories, such as magnetic and paper tapes, the amount of time required to access a storage element, to read or write, depends on how close the storage element is to the point where the data transfer is to take place.

Memories are also classified by their storage mode, that is, they can read/write or read only memories.

In read/write memories, data in a storage element can be read, or it can be altered under program control. The data in read-only memories cannot be altered. Both types of memories are widely used in microprocessor applications. However, in computers and minicomputers, read only memories are mostly used to contain the routines required for sophisticated programs.

There is some confusion in the naming of memories. For example, the name RAM (random-access-memory) is presently applied to read/write memories only, when in reality semiconductor ROMs, or read only memories, can be accessed at random also.

This problem comes from the early days of computers when a random-access-memory always implied a ferrite-core read/write memory. To avoid confusion we will follow the present usage of the word RAM to identify read-write memories only and the word ROM to identify read-only memories.

Memory Hierarchy

In addition to the classification of memories, it is often necessary to classify memories by hierarchy. Hierarchy is concerned with how fast data stored in the computer memory can be accessed during the execution of the program.

The need for memory hierarchy comes from the two types of characteristics desired from memory: a) High Speed; b) High Capacity.

All data and program instructions are stored in memory, therefore, high speed access is required to allow the computer to process the data at an acceptable rate. By the same token, it is also required that the computer have enough storage capacity to hold all the data and programs used by the system.

It would be ideal to employ the same memory to store all the data and retrieve it at adequate speed. Unfortunately, high access speed and high storage capacity are generally mutually exclusive.

To solve this problem, computers are generally provided with a relatively small amount of high speed memory, which forms the primary or *main memory* of the computer, and with a larger amount of secondary, and even tertiary, slower types of memory with large storage capacity. Stored programs and data are transferred to and from the main memory as required (Figure 39).

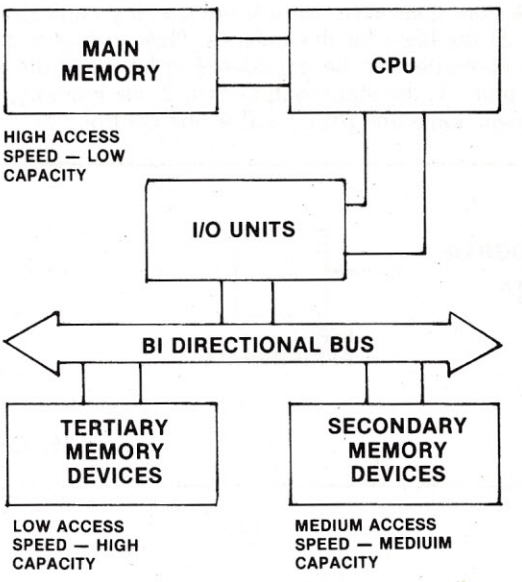


Figure 39. Memory hierarchy.

The main memory employs high speed random access core or semiconductor memories with access times which may vary from 100 ns (nanoseconds or 10^{-9} seconds) to 1 microsecond (us = 10^{-6} seconds).

Microcomputers are usually designed to access 65K bytes of main semiconductor type memory, but usually have between 4K and 32K memory locations. Large computers may have hundreds of thousands magnetic core main elements with words many bytes long, combined with secondary magnetic disks and tertiary magnetic and/or paper tape memories capable of storing millions of bytes.

The primary storage unit, or main memory, is part of the central computer, while the secondary and tertiary memories are usually devices independent of the central computer, transferring data to and from the central computer by means of input-output ports.

Because of this type of interfacing, magnetic disks used in secondary memories, and magnetic and paper tape (and similar storage units) used as tertiary memories are often considered input-output devices.

ARITHMETIC/LOGIC UNIT (ALU)

The arithmetic/logic unit is, in essence, a device by which the four fundamental arithmetical operations (addition, subtraction, multiplication and division) are performed by using registers, counter, logic circuits and other electronic devices.

The data registration is accomplished by means of electrical pulses generated by the machine's pulse generator or clock. The numerical system employed to store the data, and to perform the calculations, is not necessarily the decimal system. The binary system is commonly used.

CONTROL UNIT

The responsibility of the "Control Unit" is to sequence the operation of the entire system. Its actions include: directing the reading of information from memory; controlling the inputs and outputs of the computer; directing the operations within the arithmetic unit; and transferring information back

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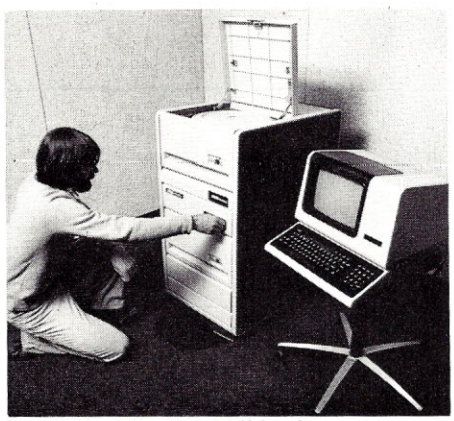

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into the memory. To perform these actions, it is necessary for the control unit to determine each operation, and decide where to place the results. The control unit accomplishes this by generating sequences of timing and control signals which cause the computer to perform the desired operations.

Computer systems are typically sequential digital circuits. They are synchronized on the basis of a standard clock signal that is provided throughout the system. Each section of the computer is designed to make a sequential transition after a predetermined number of clock pulses.

CENTRAL PROCESSING UNIT (CPU)

In Figure 39 we identified a certain portion of the computer as the CPU. Generally, it refers to the section of the computer called the "brain" of the computer. At present, this name takes an additional meaning since it is also used to refer to a microprocessor large-scale-integrated circuit (LSI), such as Intel's 8080A, Motorola's 6800, etc. Note in Figure 40 that the CPU consists of (a) the control unit, which controls the sequences of all CPU, memory and I/O operations; (b) the ALU (Arithmetic Logic Unit) and associated circuits, and (c) a number of registers to hold data.

Registers

A register is a storage element which is used to hold data used by the computer. In relation to the CPU, a register is a memory device which is part of the CPU proper, rather than part of the main memory.

Registers are simply designated areas within the CPU where a word may be stored. Each register is assigned a code (usually in the form of a binary number) instead of an address.

Registers are classified according to the function they perform in the CPU. Accumulators, program counters, instruction register, address registers, data registers, and other general purpose registers are all commonly used basic data words. However, some special purpose registers (as the address register) maybe either larger or smaller than the basic data word.

The Accumulator

The accumulator is a register which, in combination with the ALU, serves to process data. The accumulator commonly holds one of the operands to be manipulated by the ALU. For example, an instruction might direct the ALU to add the contents of some other register or from the memory, to the contents of the accumulator and store the results in the accumulator itself. In general, the accumulator is both a source (operand) and a destination (result) register.

All data placed in the accumulator for processing normally passes through the ALU. By means of the ALU, this data may be:

1. Added to the data in the accumulator.
2. Subtracted from data in the accumulator.
3. Logically ORed* to the data in the accumulator.
4. Logically ANDed* to the data in the accumulator.
5. Shifted one or more bits to the right or left.

Depending on the computer, there may be other manipulations which the CPU may be instructed to perform on data entering or leaving the accumulator.

*The meaning of Logical OR and Logical AND will be explained in tutorial Number Four.

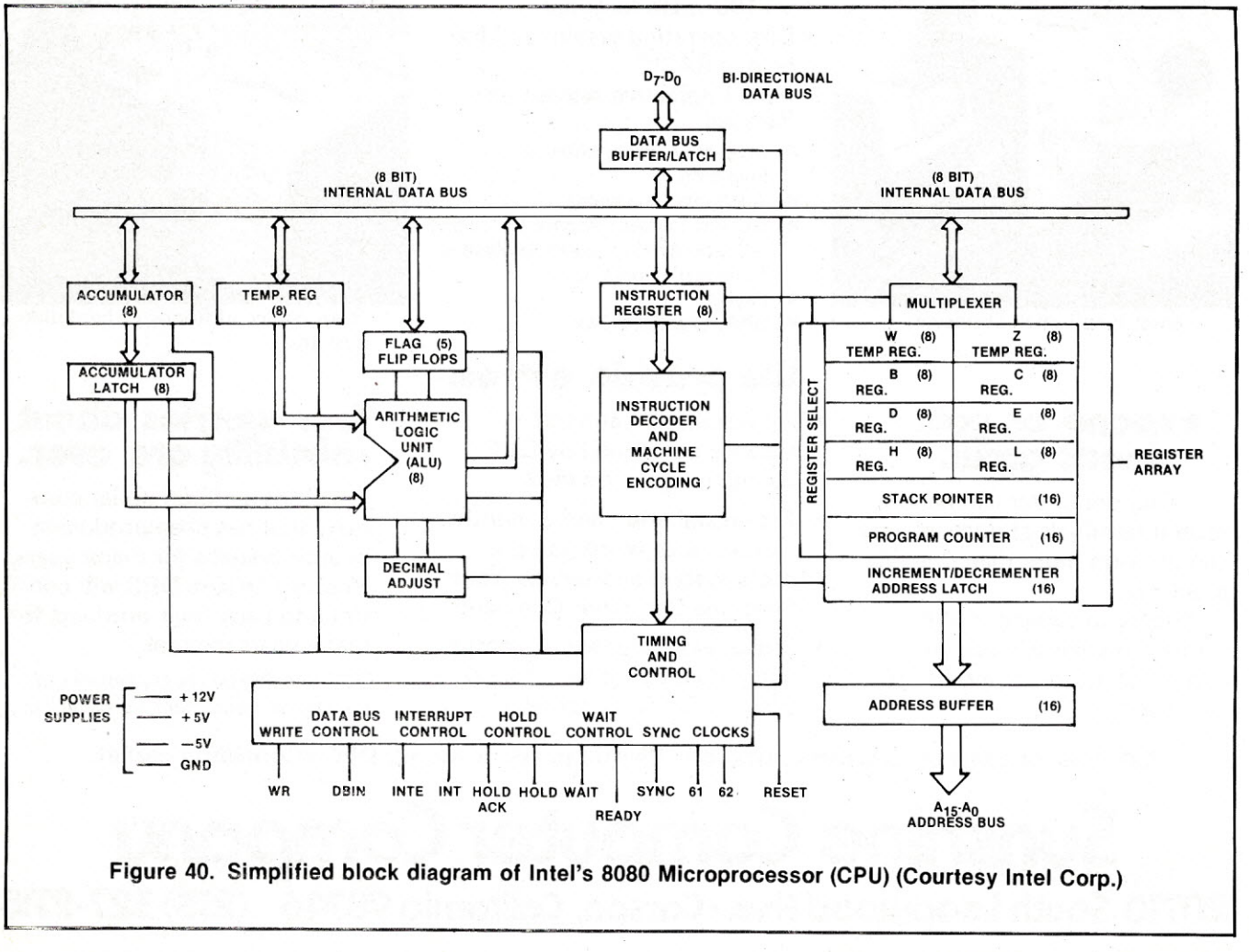

Figure 40. Simplified block diagram of Intel's 8080 Microprocessor (CPU) (Courtesy Intel Corp.)

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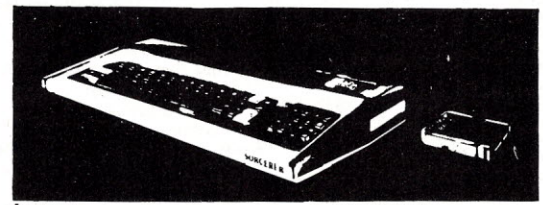

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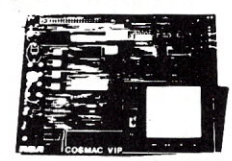

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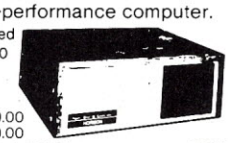

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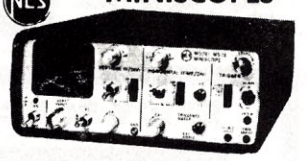

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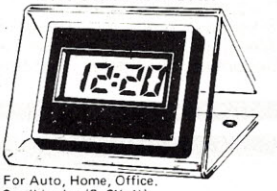

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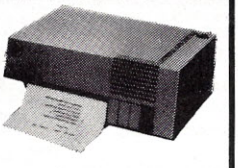

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IP-125 Integral Data System IP-125 Friction Feed Printer
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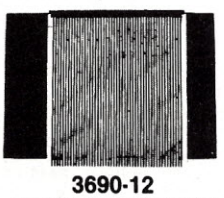

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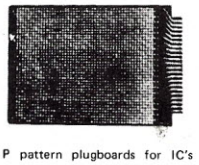

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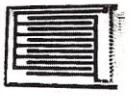

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(16K x 1, 200ns)
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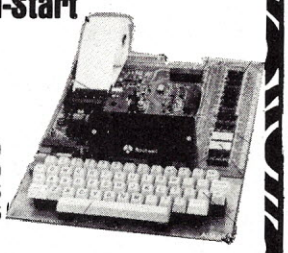

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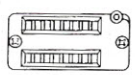

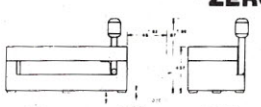

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250ns Kit $575.00

Program Counter

The instructions that make up a program are stored in the main memory. The CPU must read the contents of memory in order to determine what action to take. In order to do this, the processor must know which memory location contains the next instruction.

As was shown in Figure 37, each of the locations in memory is identified by a number to distinguish it from all other locations in memory. The number which identifies a memory location is called its *address.*

As shown in Figure 40, the CPU has a program counter which contains the address of the next program instruction. The CPU updates the program counter by adding "1" to the counter each time it "fetches" an instruction, so the program counter is always indicating the address of the next instruction.

The programmer stores his instructions in numerically adjacent addresses, so that the lower address contains the first instruction to be executed and the higher address contains the last instruction. The only time the programmer changes this sequential rule is when the instruction he is storing in memory is a "jump" instruction to another section of memory.

Jump Instruction

A jump instruction contains the address of the instruction which is to follow it. The programmer may store this instruction in any memory location, as long as the programmed jump specifies the correct address. During the execution of a jump instruction, the CPU replaces the content of its program counter with the address indicated by the jump.

SUBROUTINES

A special kind of program jump occurs when the stored program "calls" a subroutine. In this kind of jump, the processor is required to "remember" the contents of the program counter at the time that the jump occurs. This enables the processor to resume execution of the main program when it is finished with the last instruction of the subroutine. This is done by incrementing the program counter and storing the counter's contents in a reserved memory area known as the "stack."

A subroutine is a program within a program. Usually it is a series of instructions that must be executed repeatedly in the course of a program. Routines which calculate the square, the sine, or the logarithm in a program are good examples of functions often written as subroutines.

Assume, for instance, that at several points in a lengthy series of calculations it is necessary to extract a square root. The series of instructions necessary to perform the square root operation may be stored in addresses sequential with the addresses of the other steps of the calculation. These same instructions, however, will have to be stored again at each point in the calculation requiring the extraction of a square root.

Alternatively, the series of instructions for the square root operation may be stored only once in a series of addresses not sequential with those of the other steps of the calculation. Each time the need for a square root operation arises, a call instruction (call of a subroutine) directs the computer to the address of the first step of the square root instructions.

As an example, suppose that the instruction stored in address 40125 may be "call 40150". The instructions stored in address 40150, say address 40175, will then be executed in sequence.

The last instruction in any subroutine (in this example 40175), is a Return. Such an instruction need specify no address. When the CPU fetches a "Return" instruction, it simply replaces the current contents of the program counter with the address on the top of the stack. This causes the processor to resume execution of the program at the point immediately following the original call instruction.

NESTING OF SUBROUTINES

Subroutines are often *nested*; that is, one subroutine may call a second subroutine. The second subroutine may call a third, and so on. This is possible only when the CPU has enough stack registers to store the necessary return addresses, and the provision for doing so. In other words, the maximum number of subroutines that can be nested is determined by the depth of the stack. If the stack can store ten return addresses, then ten levels of subroutines may be nested.

Processors have different ways of maintaining stacks. Some have stack registers built into the processor itself. Other processors (as Intel's 8080) use a reserved area of external memory as the stack and simply maintain a "stack pointer" register in which the address of the last stack entry is stored. The external stack allows virtually unlimited subroutine nesting.

The use of subroutines and subroutine nesting results in an economy of storage space by eliminating the necessity of repeating identical instructions at many points in a program.

CONDITIONAL TRANSFER (FLAGS)

The computer can be, and usually is, designed in such a way that a jump or call will occur if and when certain conditions arise in the computer. This is known as a conditional transfer. The CPU contains "flag" bits which specify when these special conditions arise in the course of logical and arithmetic operation.

Flags will indicate (1) a zero condition in the accumulator, (2) the presence of a negative number in the accumulator, (3) overflow resulting from an arithmetic operation which produces a result with more bits than can be held in the accumulator, and a variety of other special conditions.

The flag circuits which sense these conditions can provide the signals to initiate a conditional transfer. Conditional transfers may be used to branch the computer into a different series of instruction addresses (jump), or to guide the computer into a subroutine from which it eventually returns to the original sequence of instructions (call).

PROGRAM

As we learned, the control section operates on the basis of a sequence of instructions called a *program.*

Each instruction consists of two parts: an operator and an operand (Figure 41). The operator specifies the operation to be performed by the computer (arithmetic operations like ADD, logical operations like AND, or control operations like JUMP). The operand specifies the data or the address in memory which contain the data to be operated upon.

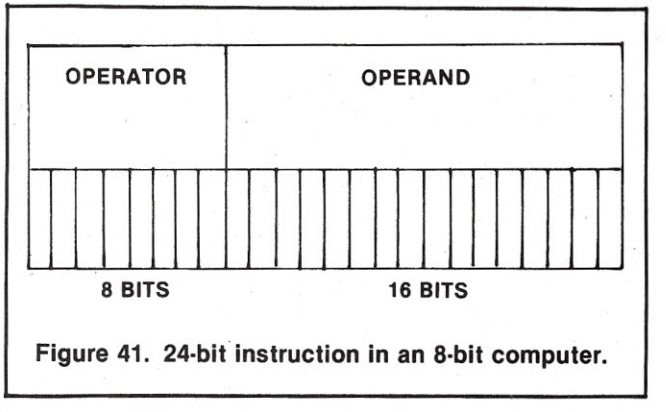


Figure 41. 24-bit instruction in an 8-bit computer.

This address is identified by a number. For example, a semiconductor RAM memory of 16K storage zones has 16K address, each one identified by a number. If the processor is of 8 bits, each address zone is capable of storing 8 bits in a parallel. Therefore, both operator and operand are stored in memory in consecutive memory zones as 8-bit binary numbers.

MANAGE

NATURAL LANGUAGE DATA BASE MANAGER FOR THE ALPHA MICRO SYSTEM

Allows processing of files by sentences written in English, rather than by programs written in a computer language. For example, you may ask the computer to "List prospects whose interest is houses and whose price is between $60,000 and $90,000 by Zip Code as labels".

Definitional capability allows easy categorization of records into terms meaningful to the user. For example, telling the computer "DEF: Pasadena Residents: Mailing whose Zip Code is between 91101 and 91108 but not 91102" would allow subsequent processing using only the words "Pasadena Residents" to refer to that group. User defined terms are unlimited in form, length and number.

Help messages are available throughout the system for user convenience. By simply entering a question mark, at any time, the system will respond with a message specifying the type of input MANAGE is expecting. Dual question marks will print the message in greater detail. Triple question marks will display a complete, menu driven user's manual.

Other special features include: user defined, unlimited length fields; access from user programs via command files; passwords; background processing; and flexible output formatting.

A new approach to memory management optimizes the mapping of data, and the loading of programs, for maximum operating speed in the amount of memory available in the user's system. This is done automatically, and is transparent to the user. Thus thousands of records can be stored, ordered, categorized and otherwise processed in a matter of seconds, rather than in minutes or hours. Practical applications include:

Mailing lists	Real Estate listings
Market analysis	Quality Control Records
Inventory files	Telephone directory
Personnel files	Reservation system
Customer listing	Mail order management
Buyer's Guide	Library cross indexing
Budget Analysis	Appointment scheduling
Price lists	Employment agency files

A ready-to-use disk, with complete user's manual, is priced at $1250. A demonstration disk, with a maximum capacity of 90 records, is available for $100. Manual only, $5.00. Enhanced versions, as they become available, will be available to all users for a copying charge of $25.00, including revised manual.

The Byte Shop of Lawndale offers complete, turn-key systems with Video terminal, High speed printer, 48K memory, and a 10 Megabyte hard disk drive at prices starting at $15,750.

BYTE SHOP OF LAWNDALE

16508 HAWTHORNE BLVD., LAWNDALE, CA. 90260 • PHONE (213) 371-2421

HOURS: TUE.-FRI. 10-7, SAT. 10-6, CLOSED SUN. & MON. WE'RE 3 MILES SOUTH OF THE L.A. INTL. AIRPORT, 3 BLOCKS SOUTH OF SAN DIEGO FWY.

EXAMPLE OF PROGRAM

As an example, suppose that we are to prepare a program to solve the following addition problem:

$$88 + 33 + 16 = 137$$

The problem must be divided into elementary steps, each step selected according with the instruction set of the computer.

Usually a small computer deals with two operands at a time. The first operand fetched from memory is transferred to the accumulator and the second operand fetched from memory is added to the accumulator. The result is stored in the accumulator. This result can be sent to memory, to an output device or left in the accumulator to add another operand to it.

To prepare the following program example, we have arbitrarily decided that the *program* should be stored starting with location 100; *data* should be stored starting in location 200, and the *result* should be stored in location 400.

The instructions and data should be coded in binary form, but for the sake of simplicity we will use symbolic notation for the instructions, and decimal numbers for data.

The first step consists of recording the data in memory, as follows:

88 in address 200
33 " " 200
16 " " 202

Knowing the address of the data, the program is prepared as follows:

associated control circuitry. An 8-bit instruction is often sufficient to specify a particular processing action. However, the execution of the complete instruction containing operator and operand sometimes requires more information than 8 bits can convey. The first 8 bits of the instruction code identifies the operation to be performed, but is insufficient to specify the operand address as well. In this case, a 2- or 3-byte instruction must be used.

When the instruction containing operator and operand consists of more than one byte, the programmer assigns locations to successive instruction bytes and the processor performs two, three or more fetches in succession to obtain the full instruction. The first byte retrieved from memory is placed in the processor's instruction register and subsequent bytes are placed in temporary storage in data registers. The processor then proceeds with the execution phase. Such an instruction is referred to as "Variable Length".

ADDRESS REGISTERS

Although not used in all microprocessors, some computers' CPUs have a register or a register-pair to hold the address of a memory location. By placing the contents of the address register on the memory address bus, the computer can then access or alter the contents of that memory location. If the address register is "programmable" (i.e., if the processor allows the programmer to alter the contents of the register), the program can "build" an address in the address register prior to executing a memory reference instruction (i.e., an instruction that reads data from memory, writes data to memory or operates on data stored in memory).

Table 1. Program

	INSTRUCTION		
Location	Operator	Operand	Comment
100	CLEAR	A	Accumulator contains 000
101	ADD	200	Accumulator contains 88
102	ADD	201	Accumulator contains 121 (88 + 33)
103	ADD	202	Accumulator contains 137 (121 + 16)
104	STORE	400	Contents of accumulator stored in location 400
105	HALT		Stops program

PROGRAM EXECUTION

To execute the program, the program counter is set to the first instruction address (100), and the program is started.

The first operation that the processor will perform is the fetching of the first byte of the instruction which corresponds to the operator code. An operator code containing eight bits (as used in microprocessors) can distinguish between 256 different actions, more than adequate for most processors.

The processor fetches an instruction in two distinct operations. First, the processor transmits the address in its program counter to the memory. Then the memory returns (through the data bus) the address memory content to the processor. The CPU stores this instruction — which corresponds to the operator — in the "Instruction Register", and uses it to direct activities during the remainder of the instruction execution.

The means by which an operator code is translated into specific actions is beyond the scope of this tutorial. The concept, however, will be clarified in a later tutorial. For now, it will be sufficient to know that eight bits stored in the instruction register can be decoded and used to select 256 lines, each one capable of developing electrical signals that initiate specific actions.

The translation of the instruction operator code into action is performed by the instruction decoder and by the

TIMING

As mentioned previously, the operation of the central processor is sequential. The processor fetches an instruction, performs the operations required, fetches the next instruction, and so on. This orderly sequence of events requires precise timing, which is provided by an oscillator clock. This clock furnishes the reference pulses which time all processor actions.

CYCLES, STATES AND CLOCK PERIODS

The combined fetch and execution of a single instruction is referred to as an instruction cycle. The portion of a cycle identified with a clearly defined activity is called a state. And the interval between pulses of the timing oscillator is referred to as a Clock Period. As a general rule, one or more clock periods are necessary for the completion of a state, and there are several states in a cycle.

NEXT MONTH

Having covered the basic units of the digital computer, we can see that it is not of mystic origin, but a machine concocted by man, needing man to tell it what to do and how to do it. In Unit 3, the fundamental concepts which the digital computer's "insides" are based upon will be discussed. Numbering systems, binary arithmetic, Boolean algebra and logic operations are to be covered.□

SUMMARY/QUIZ TUTORIAL #2

1. The length of the memory is (A) its number of bits; (B) never larger than 5; (C) the same as its height; (D) its capacity; (E) the number of words that can be stored in the memory.
2. Digital computers, as the name implies, perform operations with data expressed in the form of (A) capital letters (B) Roman numerals; (C) digits; (D) ICs; (E) CRTs.
3. In computer terminology, a digit (A) never is a number; (B) is comprised of one or more bits; (C) is the same as a byte; (D) sometimes is called a nibble; (E) is not a character.
4. The word ROM is used to identify, (A) magnetic disk memory; (B) read only memories; (C) read/write memories; (D) magnetic core memories; (E) magnetic tape memory.
5. The primary storage unit (A) is not the main memory; (B) is independent of central computer; (C) is part of the central computer; (D) transfers data from the central computer; (E) never employs high speed random access core or semiconductor memories.
6. The section of the computer that is generally referred to as the "brain" of the computer is the, (A) CPU; (B) ALU; (C) clock; (D) I/O; (E) store.
7. The program (A) does not have to be organized; (B) is a group of non-related instructions; (C) reads the data; (D) must be organized in such a way that the CPU does not read a non-instruction word when it expects to see an instruction; (E) is an electronic device.
8. In Babbage's Folly (A) the store was the control; (B) the mill held all the data; (C) the arithmetic unit was contained in the store; (D) the mill was the automatic operator; (E) the control was the automatic operator.
9. The control unit (A) does not control the inputs and outputs of the computer; (B) has nothing to do with the sequence of operation of the system; (C) does not direct the reading of information from memory; (D) does not determine each operation that is to be performed; (E) sequences the operation of the entire system.
10. A subroutine (A) is not a program; (B) is a series of instructions that must be executed only once; (C) cannot be used to calculate the square root, the sine or the logarithm; (D) is a program within a program; (E) never has a "return" as the last instruction.
11. The word 1000001 is called a (A) bit; (B) byte; (C) nibble; (D) digit; (E) glitch.
12. The operand in an instruction word (A) specifies the address in memory which contains the data to be operated on; (B) specifies the specific operation; (C) is referred to as a jump routine; (D) is for reference only; (E) never exceeds one byte.
13. All computer processor actions are precisely timed by the: (A) ALU; (B) I/O equipment; (C) oscillator clock; (D) program counter; (E) accumulator.
14. The computer unit that directs the reading of information from memory, and the operation within the arithmetic unit is the (A) memory unit; (B) program counter; (C) control unit; (D) ALU; (E) accumulator.
15. The analog computer (A) has greater accuracy than digital computers; (B) dominates the field of computers today; (C) does not deal in real time; (D) output cannot be converted into digital information; (E) except for special applications, is not used to the extent digital computers are.
16. Please rate the second unit of the NTS/INTERFACE AGE Mini Series: (A) very good; (B) good; (C) average; (D) poor.

Card-of-the-Month

The OEI 6100 Series System

Analog Graphic 3-D Display Building Block Modules

Product Review by Roger H. Edelson, Hardware Editor

Optical Electronics Inc. (OEI) has produced a family of analog modules which provide the means of simulating a three-dimensional figure on a two-dimensional screen — the face of a CRT.

The physiological mechanism of three-dimensional sight in humans is quite complex since the process of vision is solely two-dimensional. The brain (the human microprocessor) provides depth information utilizing a number of different cues, the major cue being the error signal produced from viewing the same field from two slightly separated sites (the left eye and the right eye). For example, each eye sees an object, X, located at a slightly different position with respect to the background and foreground objects (See Figure 1). This is called binocular sight and is the primary depth determination by most animals.

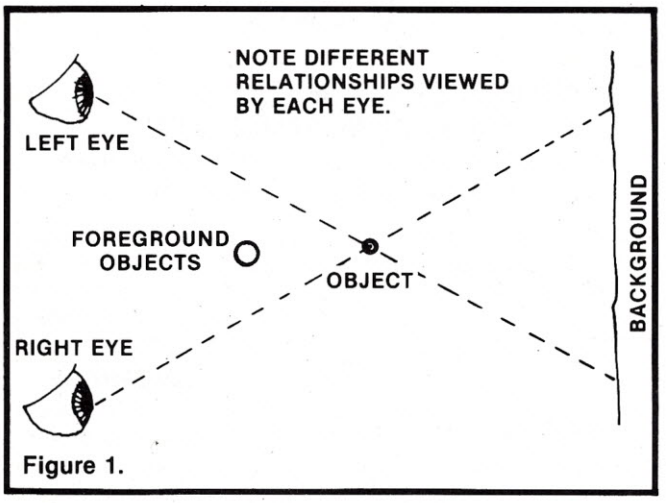


Figure 1.

However, other visual cues are relied on for perceiving the dimension of depth. One such cue is linear perspective (Figure 2).

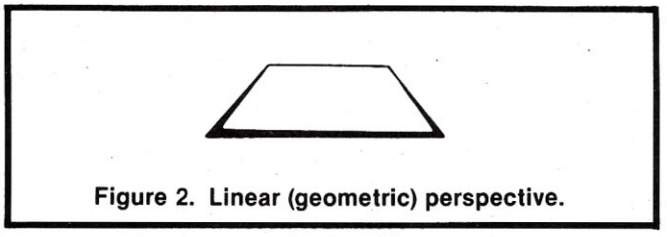


Figure 2. Linear (geometric) perspective.

The change in horizontal dimension of a flat plane viewed from an angle is perceived as the dimension of depth. One generally expects to see more distant objects higher than those in the foreground.

Interposition is another example. This occurs when one object in front of another obscures the more distant object (Figure 3.)

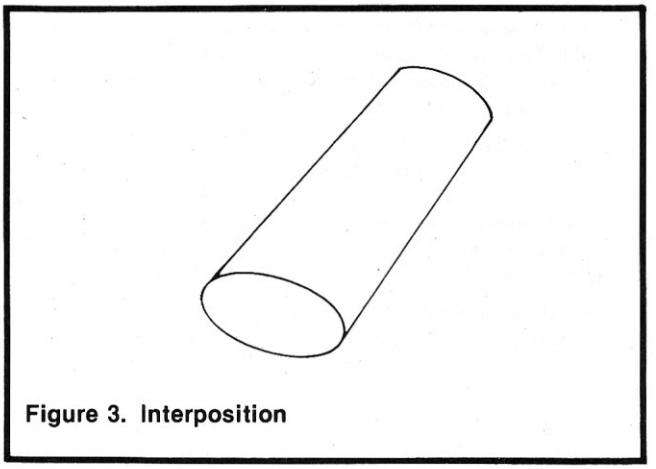


Figure 3. Interposition

Another major cue is derived from the "square of the distance" law for radiated energy; light emanating from a more distant source is perceived as dimmer than that from the closer object.

A fifth major depth cue is derived from focus information: only the desired plane is in focus and other parts of the image at differing distances will have lesser degrees of sharpness. A final depth cue is derived from the mobility of the observer. A change in observer position results in changing spatial relationships and this is directly related to the distance of the object from the observer. This depth cue is apparent in the perceived notion of telephone poles against the background of mountains as the observer moves down the road in a car.

With the exception of the binocular effects, all of the other depth cues can be simulated in a single two-dimensional display such as the face of a CRT. These effects can be further enhanced by placing a filter on the face of the CRT so that the viewer cannot locate the position of the face of the CRT with respect to the image, which would tend to negate the psychologically and physiologically derived depth information.

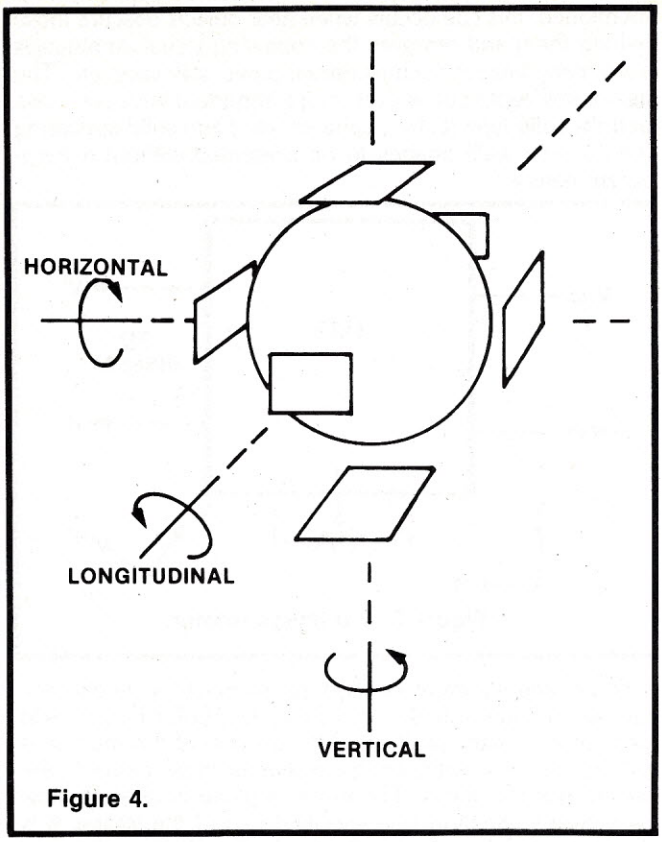


Figure 4.

OEI provides hardware which, when supplied with three-axis information, produces a display embodying the appropriate depth cues. Their sales literature suggests, in words and pictures (see Figure 4) that they provide electron beam deflection in a forward and backward direction in addition to the normal horizontal and vertical displacements of the beam.

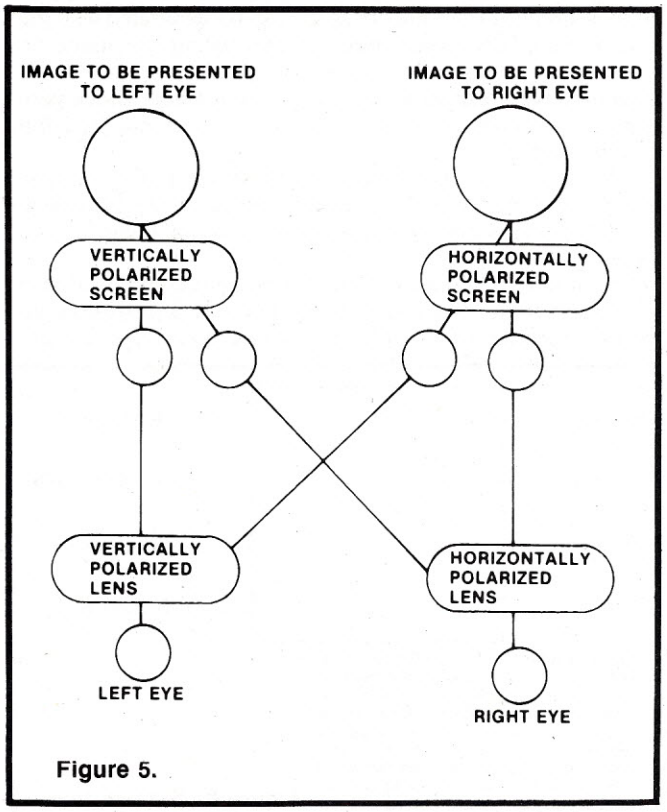


Figure 5.

This and the statement that a *spherical* (not circular) display volume is provided, are just not true; however, it does provide all the equivalent monocular depth cues which an observer would derive from such a spherical display. Additionally, a device is provided which will present two images possessing the binocular depth cues introduced by interocular separation.

The user must provide a means for presenting each image to its respective eye; common techniques are to use polarized screens and glasses or colored screens (to color the images) and appropriately colored lenses (this technique was used in the rash of 3-D movies that appeared briefly). See Figure 5 for a diagram representing these systems.

The OEI analog graphics 3-D display building block modules are a family of analog functional blocks that can be combined together in various ways to form an analog system capable of simulating 3-D presentations.

Called the 6100 series 3-D display system, these modules drive conventional X-Y CRT (two-dimensional presentation) type displays and provide input ports for the three orthogonal signals, horizontal, vertical and longitudinal. The horizontal and vertical inputs produce deflections of the electron beam along their respective axes. The longitudinal input modifies these deflections and the intensity and focus of the CRT beam. These modifications provide a display which simulates the depth cues which would result from such depth (longitudinal) information.

In addition to providing three orthogonal deflection axes, the 6100 series system provides continuous 360° rotation any, or all, of the three axes. All the monocular depth cues mentioned above, including geometric and aerial perspective, interposition, movement parallax, and depth of focus field are produced by the modules of this system. Binocular (stereo) images may also be produced containing all the other depth cues with the sole exception of the eyeball pointing vector.

Besides the depth cues, the 6100 series system provides superimposition capability to mix two or more graphic or alphanumeric images together. One module of this series will generate orthogonal axes for display, and an electronic reticle can be generated by another function block.

The provision of this variety of modules enhances the flexibility of the system by providing the ability to use just one basic module (the 6114) or a number of combinations of up to fifteen modules. The following paragraphs will illustrate some of the capabilities and combinations of the analog 6100 series modules.

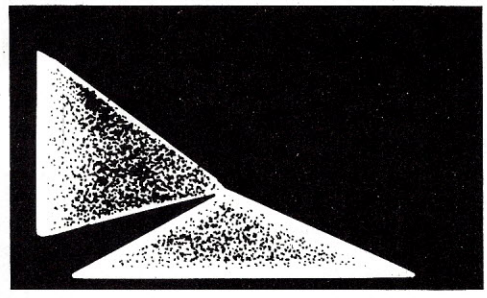


Figure 6.

The 6114 Three Dimensional Display Channel Amplifier will provide both geometric and aerial perspective based on object to viewer distance (Figure 6). This perspective is necessary to avoid ambiguity in most images, and the 6100 series system has the capabilities of generating infinite perspective for images that include the vanishing point.

This module also provides the necessary processing to produce images possessing the interposition depth cue. As mentioned, this cue occurs when near objects obscure those behind them and removes the confusing visual ambiguities from many images such as boxes, pipes, stairways, etc. The use of this depth cue is even more important because it also permits solid-type (cubes, spheres, etc.) and solid-appearing (i.e., a pipe wall) images to be presented without a transparent nature.

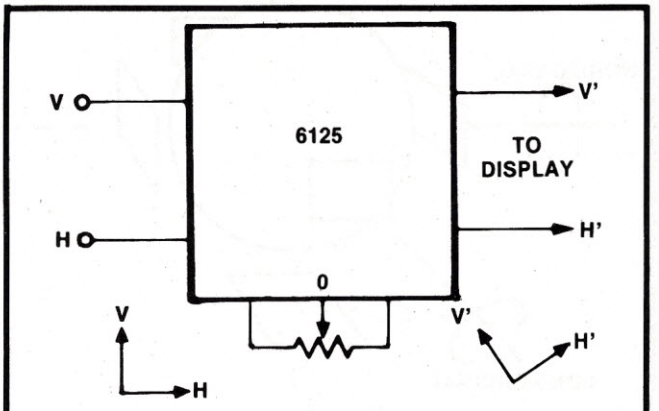


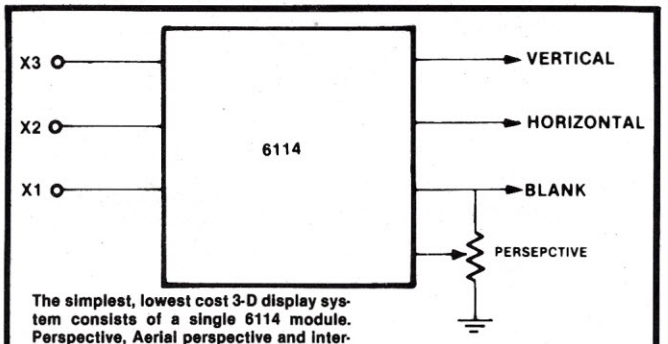
Figure 7. 2-D image rotator.

To provide the depth-of-focus (or plane-of-focus) distance cue, an optional module, the 6142 Depth Of Focus Field Generator, is made available. The function of this module is to "defocus" the entire image except for those points in the desired plane-of-focus. The in-focus plane is used to draw the viewer's attention to a specified part of the image. It is also quite useful in viewing the monocular line-type images. The 6142 module achieves its defocusing function by operating on the deflection voltages and applying a "spreading" signal, therefore requiring no connection to the CRT high voltage focus circuitry.

Movement parallax, the depth cue in which the amount of change of the relative position of objects is inversely related to their distance from the observer, can be generated with the use of the 6125 rotator module. By rotating the image on the CRT face, the point of view of the observer is actually changing with respect to the image. By rotation, movement parallax becomes visible and aids in the visual interpretation of the image.

This depth cue is particularly useful when viewing line type images and monocular images in general. Often, the viewer is not consciously aware of his use of movement parallax as a depth cue.

The model 6125 Axis Rotator module may be used as a 2-D stand alone rotator (Figure 7). The 6125 provides continuous rotation from −180 to +180 degrees. The 0 input



The simplest, lowest cost 3-D display system consists of a single 6114 module. Perspective, Aerial perspective and interposition depth cues are provided. The addition of 6 resistors and 2 op amps will provide fixed rotation or tilt to the image. This basic system has application in medical, radar, sonar and test equipment, plus computer display systems and isometric video displays.

Figure 8. Simple, low cost 3-D display system.

may be provided from a manually controlled potentiometer, as shown, or may be driven ±10 volts from a digital-to-analog converter output in a microcomputer controlled system for programmed rotation.

In many cases it is useful to increase or decrease the image size. The 6134 3-D Image Magnifier module may be used in the 6100 series system to magnify the image. The purpose is to reduce or increase the effective distance between the view and the image. All depth cues which are included in

Table 1.

SYSTEM BANDWIDTH:		DC-500KHz
Use Basic Module	MODEL[1]	6114
Axis Rotator Module	MODEL[2]	6125
Magnifier-Zoom Module	MODEL	6134
Focal Field Module	MODEL	6142
Image Multiplexer Module	MODEL	6154
Binocular-Stereo Module	MODEL	6170
Blanking Generator Module	MODEL	6182
Full Scale Input Voltage[3]		± 10 Volts
Input Resistance		100MΩ
System Rise Time		700nS
System Settling Time to 0.1%		3uS
System Output Slew Rate		± 50V/μS
System Operating Temperature Range		-55°C to + 100°C
Nominal Power Supply Voltage[4]		± 15 Volts
Minimum-System Suply Current[5]		± 40mA
Complete-System Supply Current[6]		± 463mA
Minimum-System MTBF[7]		403,000 hours
Complete-System MTBF[7]		21,300 hours

NOTES

1. One 6114 is required for a minimum system.
2. One rotator module is required for each axis of continuous rotation. One, two, or three modules may be used.
3. The full scale input voltage may be reduced to as low as ± 100 millivolts by adding external resistors.
4. Minimum supply voltage is ± 12V and the maximum is ± 18V.
5. Minimum system is 1-6114.
6. Complete system consists of the basic module, 3 rotators, 1 zoom, 1 focal, 1 multiplexer, 1 stereo and 1 blanking module.
7. MTBF is per ML-HDBK-217D-GF.

Table 2. Specifications of Model 6114

Transfer Function	Three-dimensional Display Channel Amplifier
Input	
Voltage Level	± 10 volts full scale
Resistance	100 megohms minimum
Bias Current	± 500 Amps maximum
Offset Voltage	± 1.0 millivolt maximum
Offset Voltage Drift	± 30μV/°C maximum
Frequency Response	
Bandwidth	DC to 500KHz minimum
Rise Time	700 nanoseconds maximum
Differential Phase Shift	<3°, DC to 500KHz
Operating Modes	
Rotation	With Model 6125
Image Parameter	Aerial perspective; geometric perspective, translation
Magnification	With Model 6134
Focal Field	With Model 6142
Multiple Image	With Model 6154
Stereo (binocular) Image	With Model 6170
Blanking	With Model 6182
Output	
Voltage Range	± 10 volts full scale
Dynamic Resistance	1.0 ohm maximum
Minimum Load Resistance	1000 ohms
Output Slewing Rate	± 50 volts/μsecond minimum

the particular configuration of modules will increase or decrease in accordance with the viewer distance. Normally, the magnifier module is used to reduce viewer distance (effectively enlarging the image) by a factor of 3 or more or increase the distance to infinity.

With the addition of the 6170 3-D Stereo Generator module, binocular images may be produced. Either monocular or binocular images may be selected, and all depth cues and full rotational capability remain, regardless of the selected mode.

Table 1 provides a tabular list of the system modules and the general specifications for the system. Table 2 gives the detailed specifications for the 6114 main module. A minimum system can be assembled of just one 6114 3-D Channel Amplifier as shown in Figure 8. One possible means of itnerfacing this minimum system to a microcomputer is diagrammed in Figure 9. The MC3408's are digital-to-analog converters and the other two integrated circuits are 5 volt and 2.5 volt regulators.

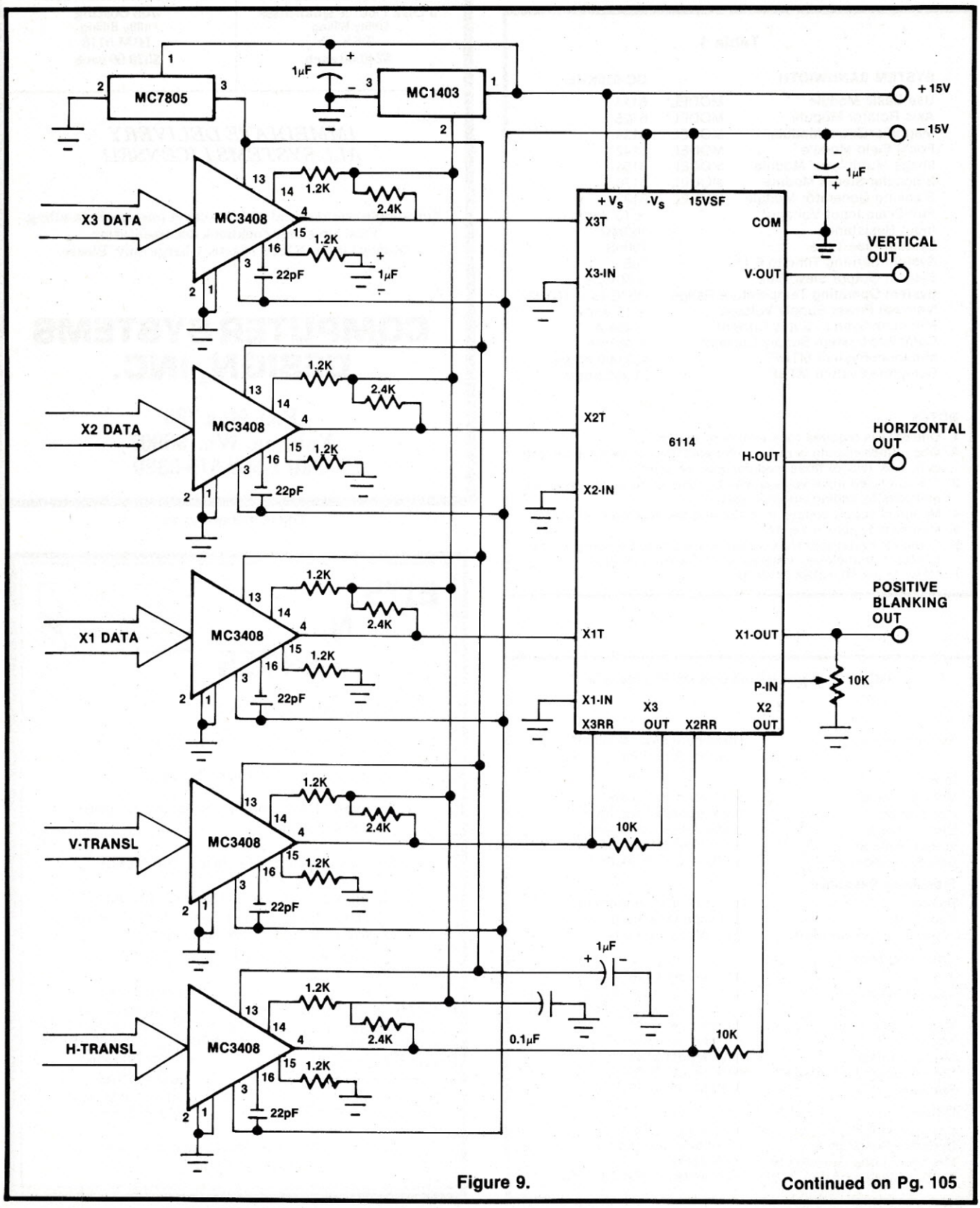


Figure 9.

Continued on Pg. 105

While others are only promising
WE'RE DELIVERING
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Cromemco System Three

Factory integrated Z80 computer with 512K 8" CP/M compatible dual disk drives, 32K memory, CRT terminal with edit and block mode, and high speed line printer. Brand new, highly professional accounting package for serious business applications; human engineered for simple operation, with interactive screen functions.

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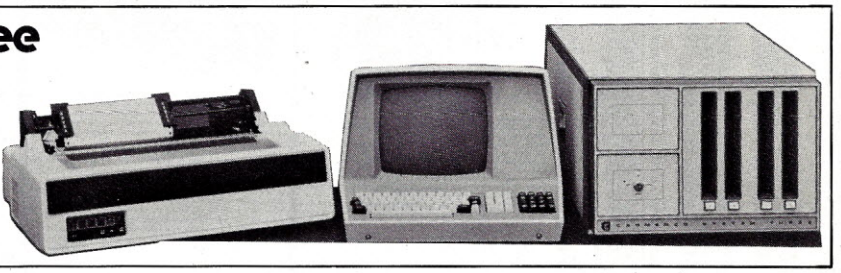

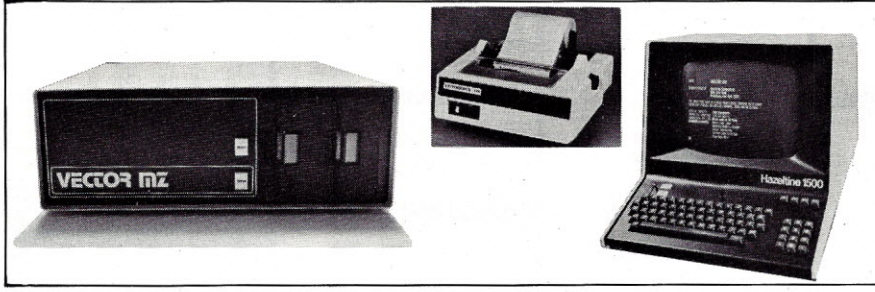

Vector MZ

Factory assembled Z80 computer with 630K dual 5" disk drives, 32K memory, 1K PROM monitor, and Micropolis extended Disk BASIC. We add Centronics 779 printer and Hazeltine 1500 CRT terminal. CP/M, CBASIC, word processing and many business application packages available at additional cost.

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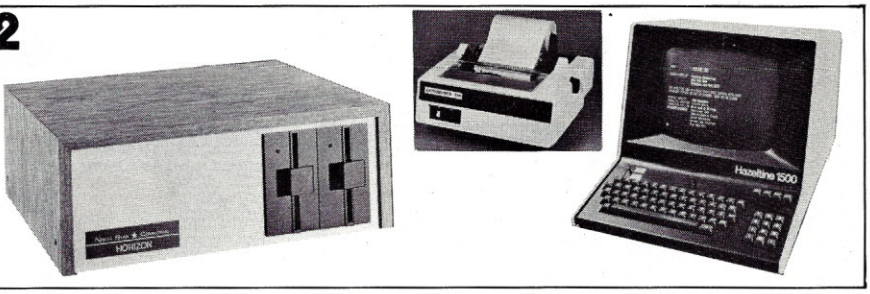
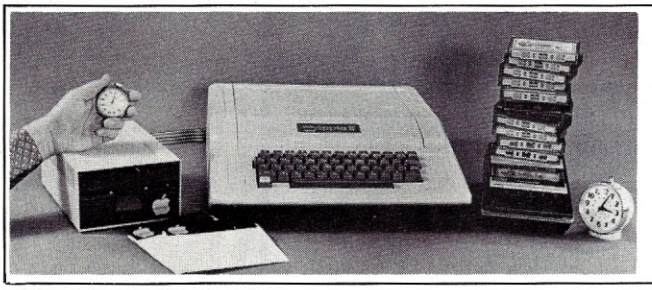
North Star HORIZON-2

Factory assembled Z80A computer with 360K dual 5" disk drives, 32K RAM memory, with all I/O ports and connectors installed. Complete with North Star Disk BASIC, Hazeltine 1500 CRT terminal and Centronics 779 printer. CP/M, CBASIC, word processing and many business packages available at additional charge.

Factory list ~~$5,685~~ **Your cost $5,147!**





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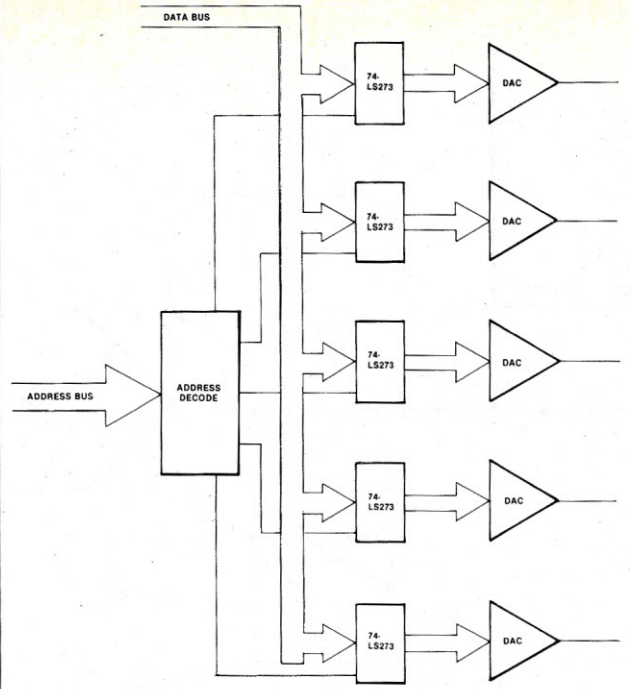
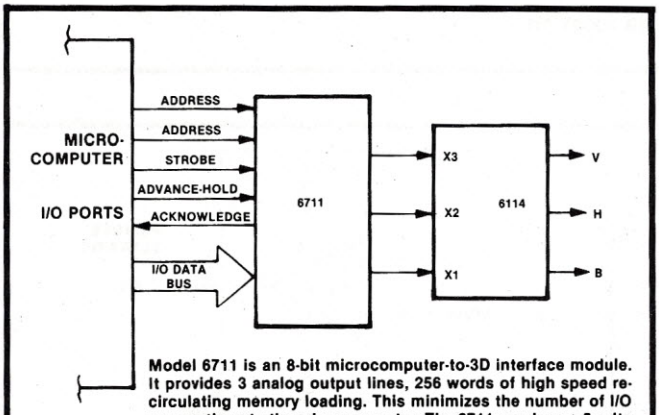


Figure 10. A common bus system for DMA or real time — full time μP output.



Model 6711 is an 8-bit microcomputer-to-3D interface module. It provides 3 analog output lines, 256 words of high speed recirculating memory loading. This minimizes the number of I/O connections to the microcomputer. The 6711 requires + 5 volts at 200mA and -12 to -15 volts at 30mA. Hard wire connections to the 6114 with no external components requires, provide a 3-D presentation of the digital data. OEI can provide exact interfacing circuits and test programs for the F-8, 8080A, 6800, 1802, 2650 and SC/MP microprocessors.

Figure 11. Microcomputer buffer/interface.

A possible bus oriented interfacing scheme is shown in Figure 10 where a single data bus decode logic on the address bus is utilized to latch 8 bit information into the various data streams. Unfortunately, because of the necessity for visual repetition rate requirements, the images must be provided at a rate of at least thirty frames per second. This requirement combined with the diagrammed hookup will keep the microprocessor busy most of the time since it must update the data streams for the image.

Direct memory access techniques, or a recirculating video memory provide a more efficient interface and free up the microprocessor for other tasks. OEI supplies the 2-D Interface Buffer, the 6711, which provides three analog output lines and 256 words of high speed recirculating memory. It does not provide interface capability for the rotational commands. Figure 11 illustrates the functional interconnection of this module and a microprocessor and the 6114.

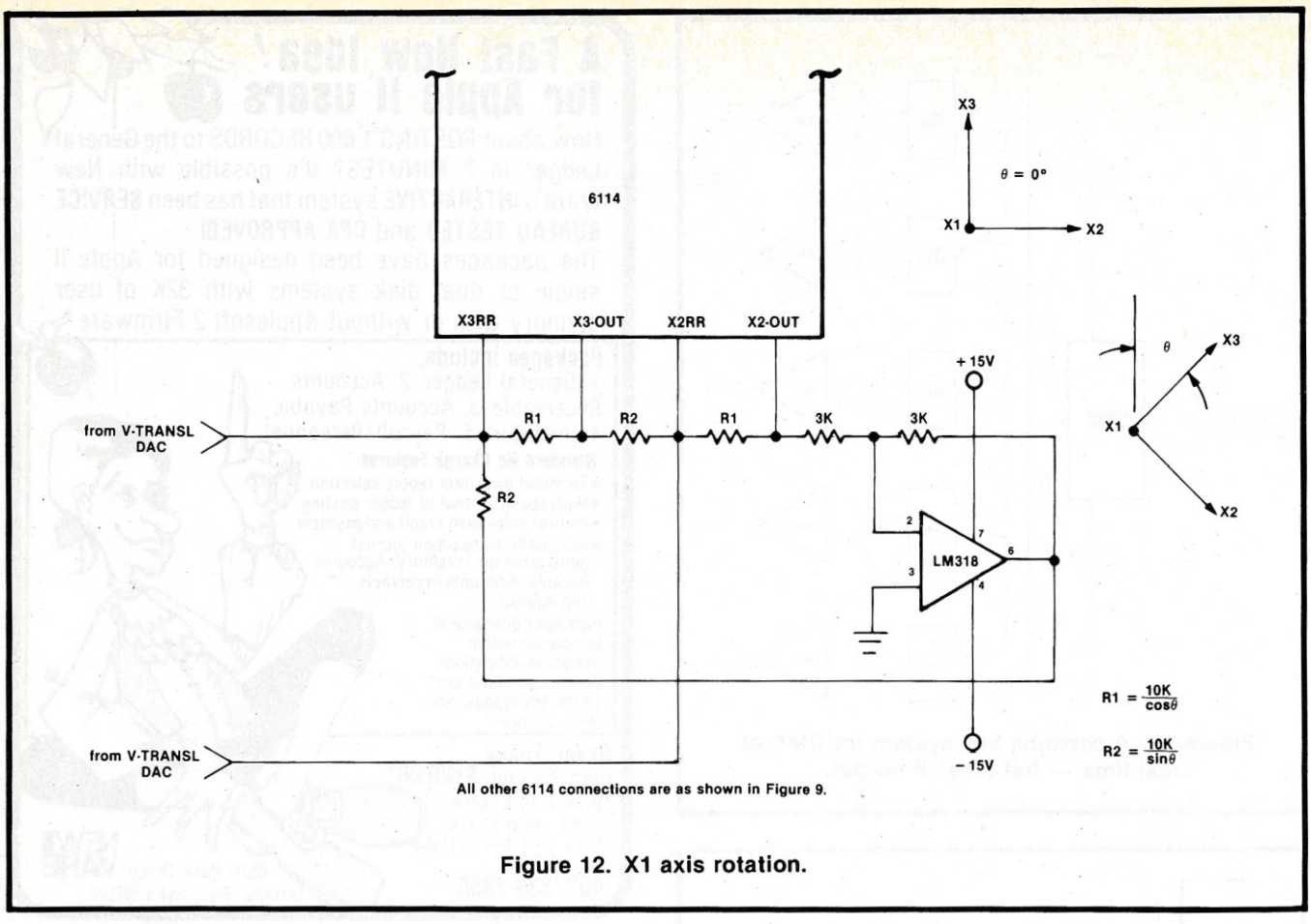


Figure 12. X1 axis rotation.

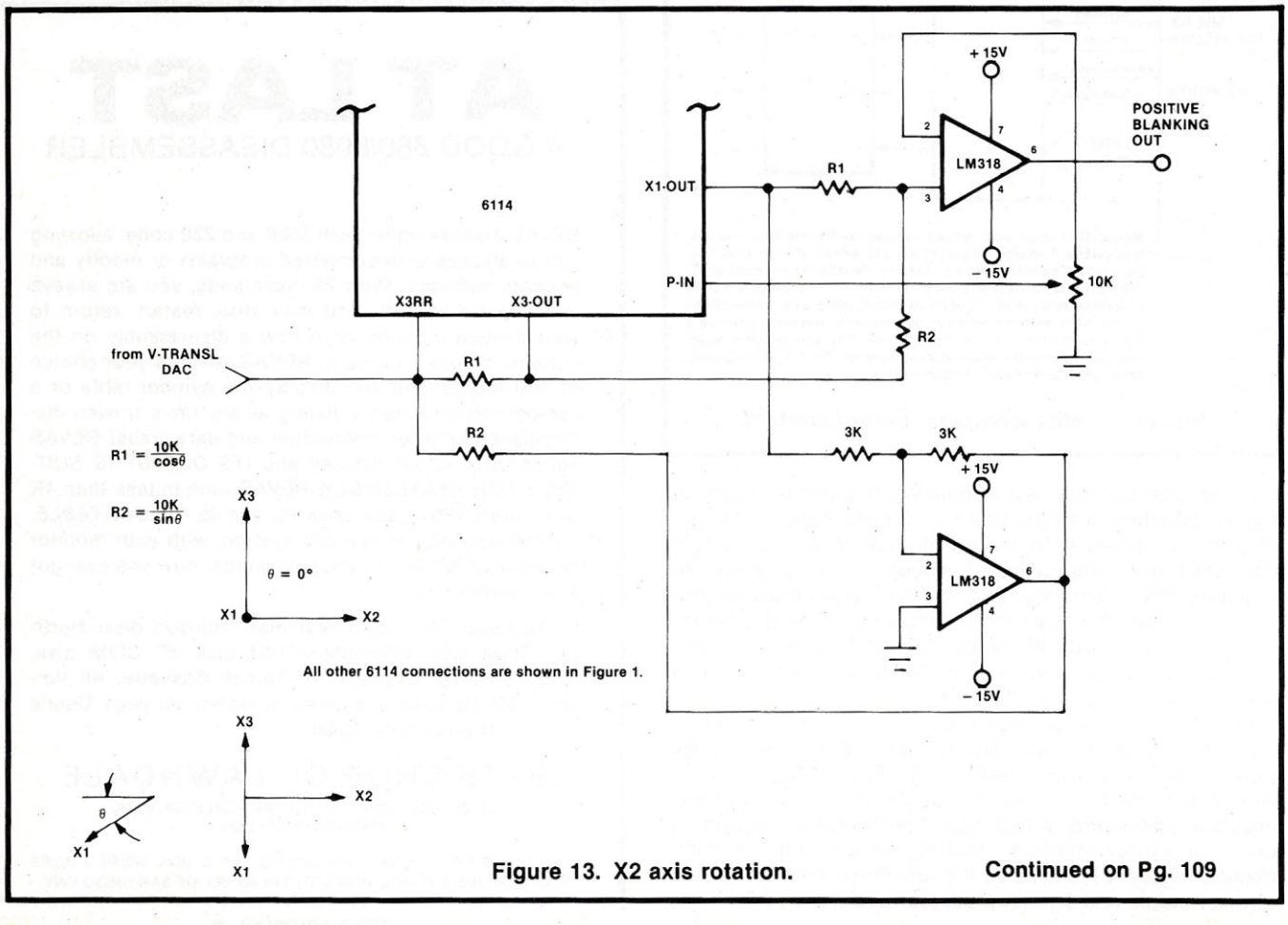
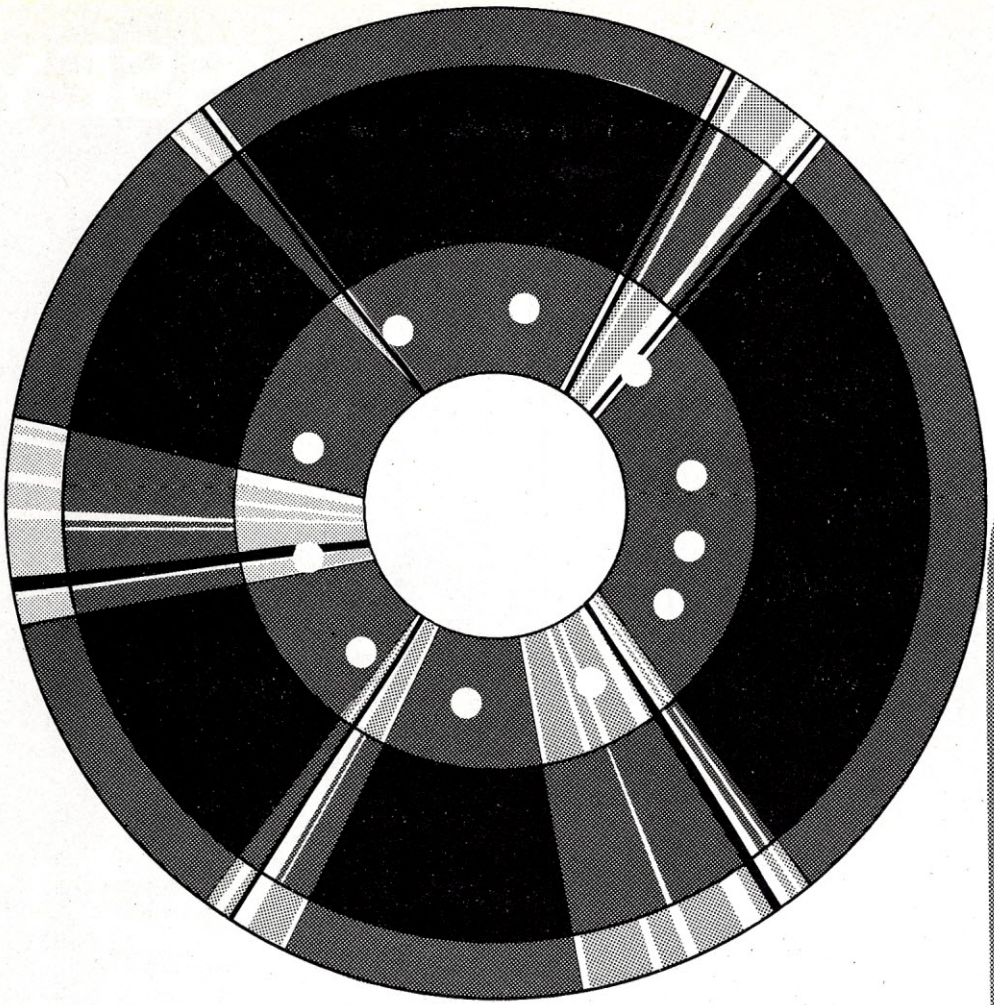


Figure 13. X2 axis rotation.

Continued on Pg. 109



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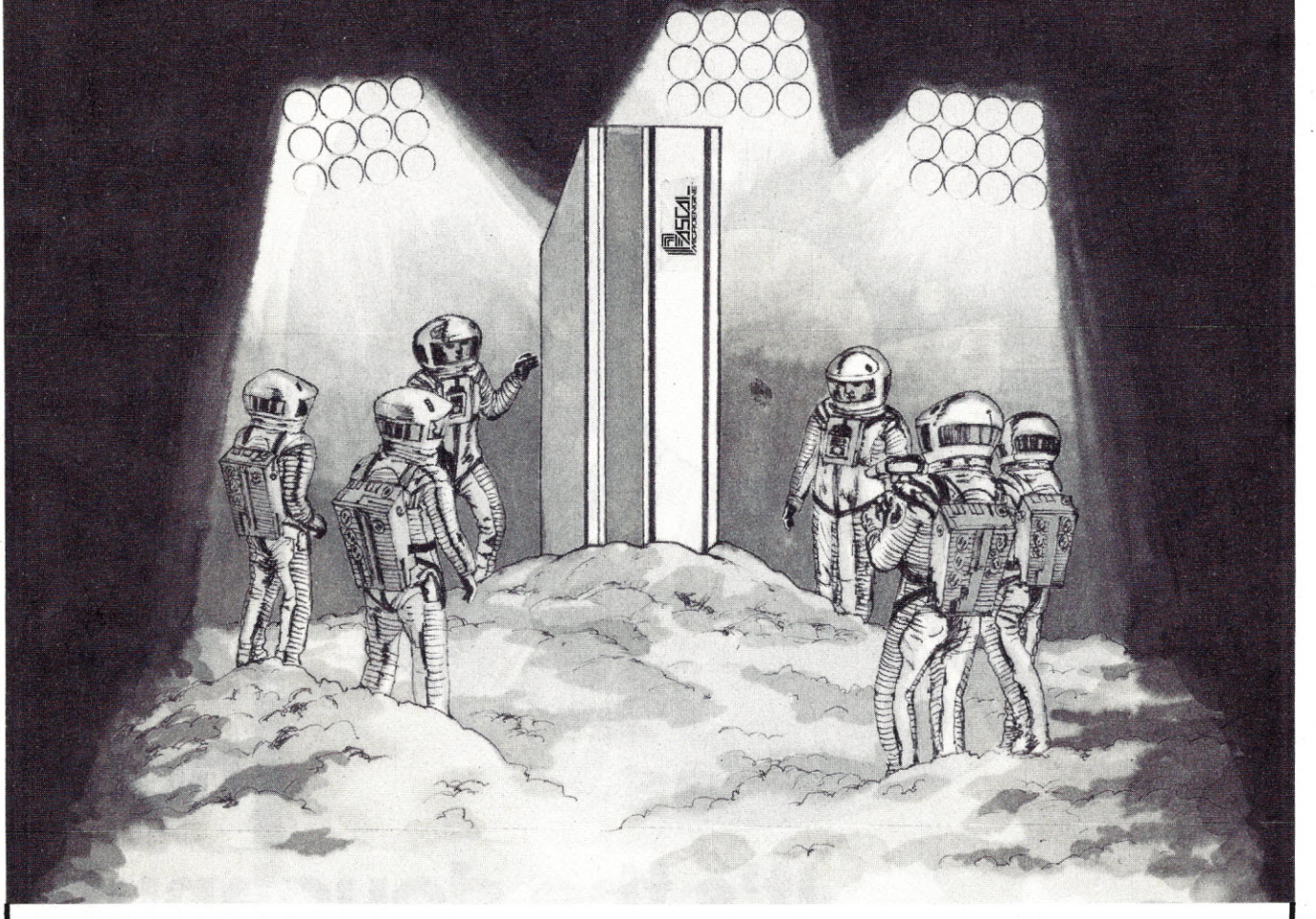
THE PASCAL ODYSSEY



WHAT'S SO GREAT ABOUT PASCAL?

The Pascal programming language is a *masterpiece* of human creativity. Originated by Niklaus Wirth at the Swiss Institute of Technology in 1968, Pascal was intended to aid in the teaching of *programming* as a *systematic discipline*, where the fundamental concepts of algorithms could be clearly and naturally expressed.

Pascal makes it easy for the user to implement virtually *any* algorithm *reliably*, at an abstract, human level, rather than having to perform the usual mind-bending contortions required by most other programming languages. The elegance of the language has resulted in an unprecedented *wave of enthusiasm* among Earth's knowledgeable computer users, toward adopting Pascal as an *international standard programming language.*

WHAT'S A MICROENGINE?

The **Pascal microengine™** is the world's first production implementation of Pascal in *hardware.* It executes UCSD Pascal intermediate code (P-code) *directly* as its *machine language*, thus being the first true "P-machine". The significance of this accomplishment should not be overlooked!

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The unit includes the complete UCSD Pascal operating system: Pascal compiler, BASIC compiler, file manager, screen-oriented text editor, program debugger, and a graphics package, all supported by thorough documentation. UCSD's version of Pascal incorporates random access file capability in addition to the sequential access capability of the original Pascal, and also includes x-y graphics.

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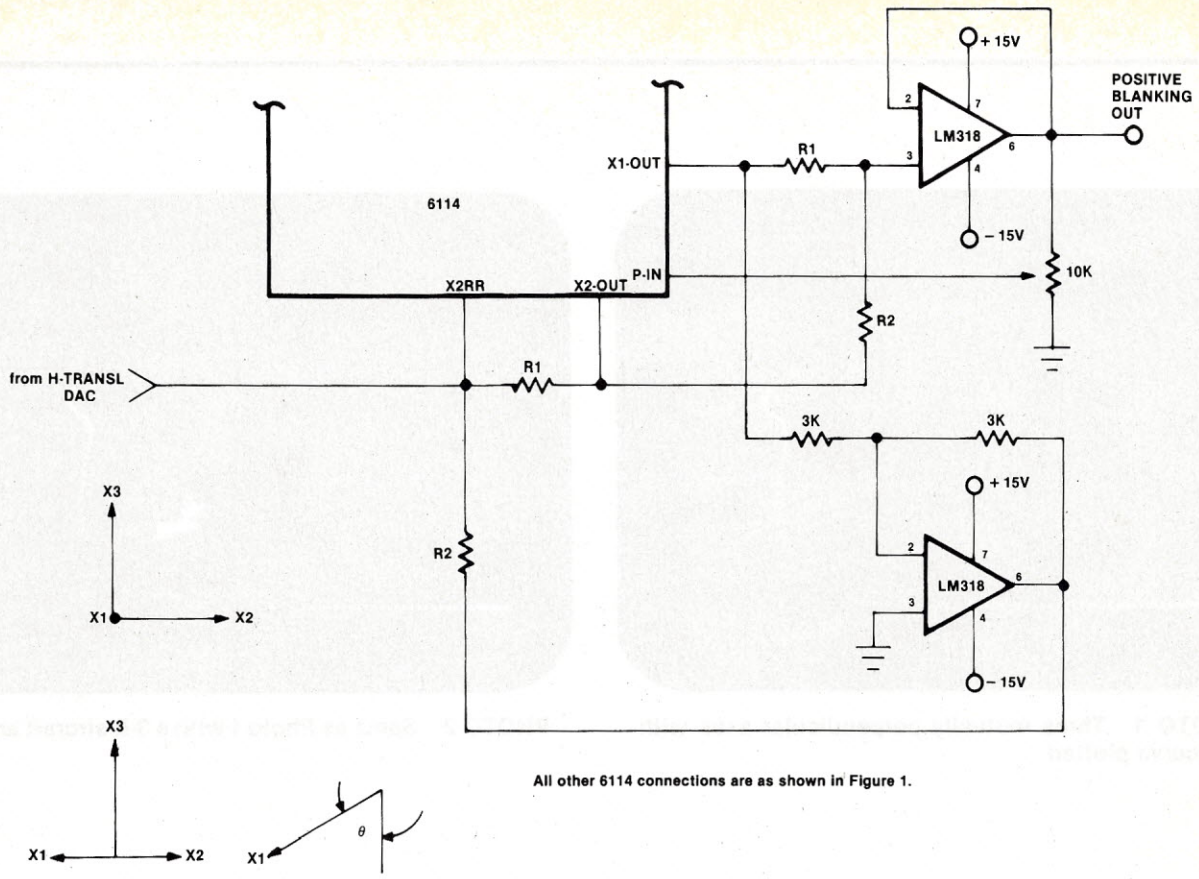


Figure 14. X3 axis rotation.

Continued on Next Page

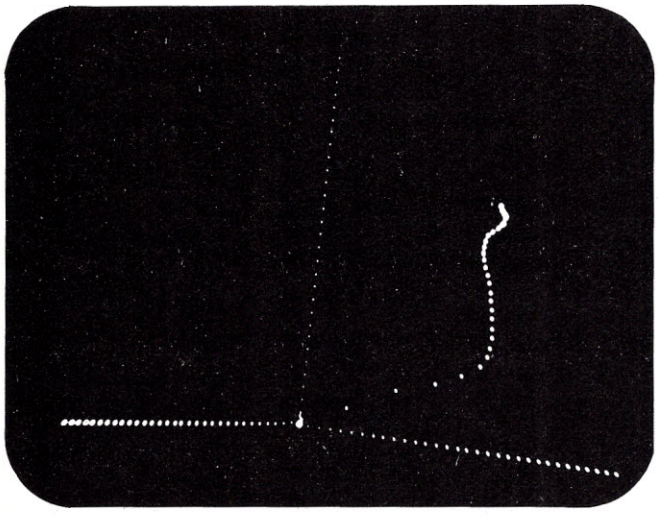


PHOTO 1 Three mutually perpendicular axes with 3-D curve plotted.

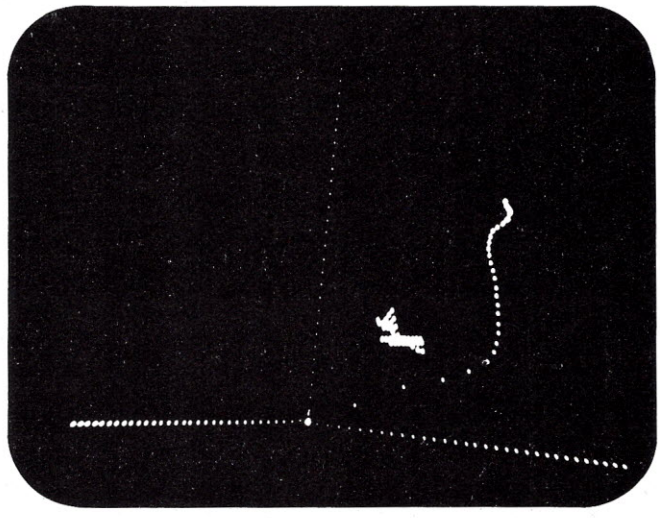


PHOTO 2 Same as Photo 1 with a 3-D aircraft added.

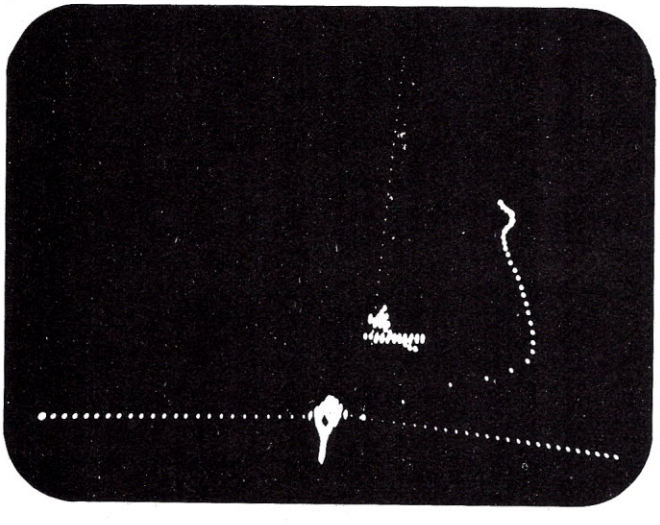


PHOTO 5 Same as Photo 3 with rotation about the X3 axis.

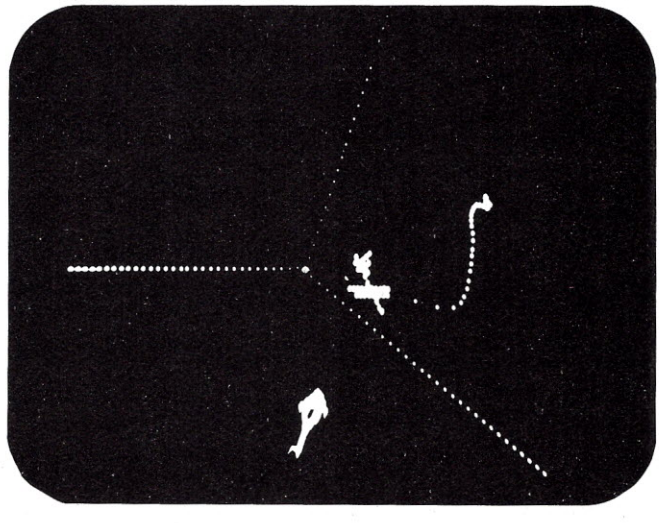


PHOTO 6 Same as Photo 3 with rotation about the X2 axis. Image was shifted upward to view.

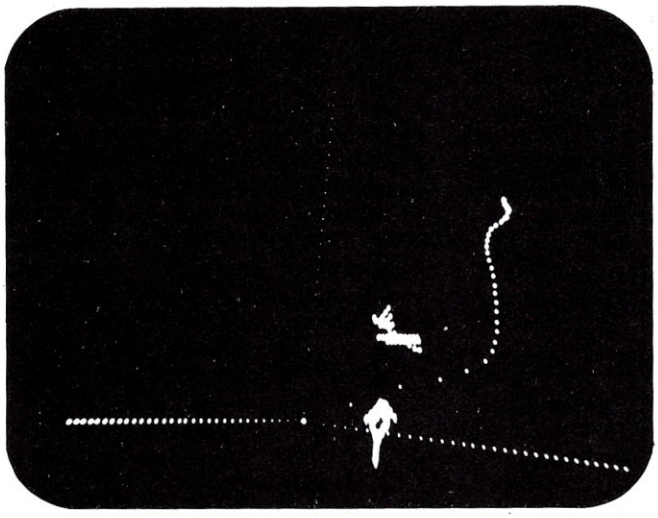


PHOTO 3 Same as Photo 2 with a 3-D tree added.

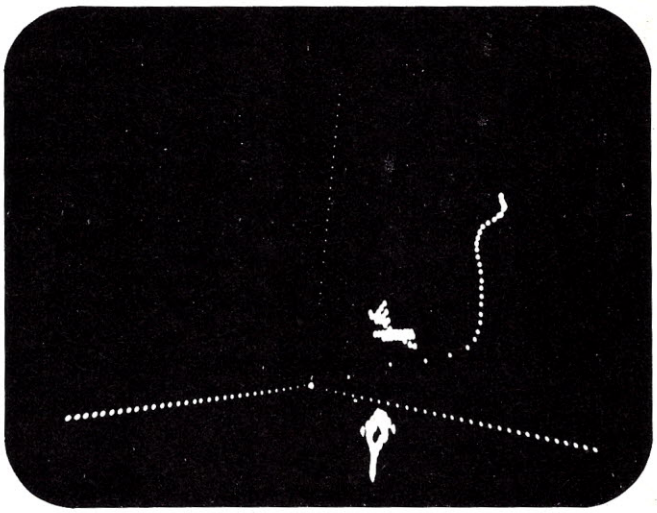


PHOTO 4 Same as Photo 3 with increased perspective. Note tree position.

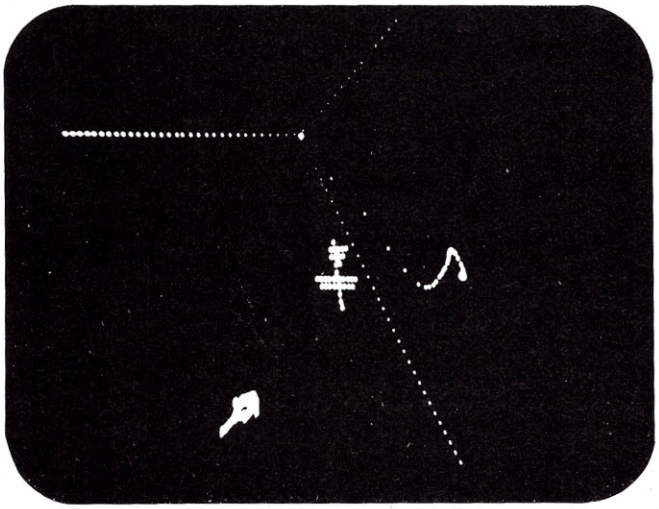


PHOTO 7 Same as Photo 6 but with more X2 axis rotation. Image was shifted upward to help view.

Figures 12, 13 and 14 illustrate the method of expanding Figure 9 to provide rotation of the X1, X2, and X3 axes. The LM318 is an operational amplifier. Photos 1 through 7 indicate some of the changes and differences that can be introduced in a simple display using the minimum system plus rotation. The images were formed from data stored in a look-up table. It is very interesting to note the changes in perspective and depth perception as the display is rotated to move the observer position.

The 6125 Axis Rotation modules may be interconnected to provide three-axis rotation. It is generally just as easy to use the other modules in conjunction with the 6113 to provide the other functions discussed previously.

OEI has provided a system of analog modules which when combined in simple configurations can be used to provide displays which simulate three dimensional viewing. The modules must be interfaced with an X-Y display device like an oscilloscope, a raster scan and video monitor will not work. Some means must be provided to get the high data rates needed to the system.

If these conditions are met, some very interesting effects and displays may be provided from a microprocessor.□

Mode LEDs for the COSMAC "ELF"

By William R. Smith

A small following of hobbyists have enjoyed building and operating the "COSMAC ELF" based on RCA's CDP-1802CD microprocessor chip. The 1802 is very versatile with features such as four sense line inputs with their own instructions, direct output of an acknowledge bit called Q with two instructions of its own, seven input and seven output ports of eight bits, each with their own instructions, and an interrupt line under software control. Add on 16 internal registers of 16 bits each, DMA I/O plus more, and this chip has great possibilities.

However, the chip does have its drawbacks. Being CMOS, careful handling should be observed. Its current loading and sourcing are not great, so interfacing to TTL must be buffered. However, interfacing with CMOS is no problem. Also, operation over 2MHz requires a higher voltage power supply and heavier duty chip. Speed is the biggest drawback, but it is not too bothersome.

After building the "ELF," a couple of features that were not presented on the original circuit were desired. These were Operation Mode LEDs, Single Step capability, Address LEDs, activation of the four sense lines, port decoding and memory expansion.

A description of how to incorporate the four mode of operation LEDs will be provided here.

There are four distinct modes of operation. They are LOAD, PAUSE, RESET, and RUN. The four modes are entered into by setting two switches on the two control lines WAIT and CLEAR. The table below shows the decoding of these two lines.

MODE	WAIT	CLEAR
LOAD	0	0
PAUSE	0	1
RESET	1	0
RUN	1	1

By decoding these two lines to operate four LEDs, the mode of operation can be immediately determined. Also to incorporate the Single Step feature, the Pause mode must be decoded. Figure 1 shows the connections needed to hook up the mode LEDs. There are two points marked A and B. These are reference points for the addition of the Single Step circuit and can be ignored for now. Wire dress and layout are not critical.

In the original "ELF" circuit, IC 5 pin 15 goes to the CPU pin 3, and IC 11 pin 6 goes to the CPU pin 2. No changes need to be made to the existing wiring.

IC 14, a CD4049 HEX Inverter, and IC 15, a CD4001 Quad 2-input NOR gate have been added. Four LEDs (XC556 or similar) and four 470 ohm ¼ watt resistors must be added. The LEDs are wired so that a ground or ZERO activate them. Operation is straightforward. In the RUN mode both control lines are high. This causes IC 14 pin 15 and 12 to go low. On IC 15 pin 11 goes high. IC 14 pin 10 then provides a low or ground through R1 to the RUN LED, causing it to light. The other LEDs remain off due to IC 14 pins 2, 4, and 6 remaining high, thereby not providing a ground to their LEDs.

In going to the PAUSE mode, the WAIT line goes low. IC 14 pin 15 then goes high and causes the RUN LED to go out. IC 14 pin 12 does not change, and IC 15 pins 8 and 9 are now both low. This causes IC 15 pin 10 to go high, and a ground is sent to the PAUSE LED through R2 from IC 14 pin 2.

In the LOAD mode, the CLEAR line drops low. Now IC 15 pin 8 goes high and causes our PAUSE LED to turn off. IC 15 pins 1 and 2 are now both low, making IC 15 pin 3 high. The LOAD LED turns on with the ground provided by IC 14 pin 4 through R3.

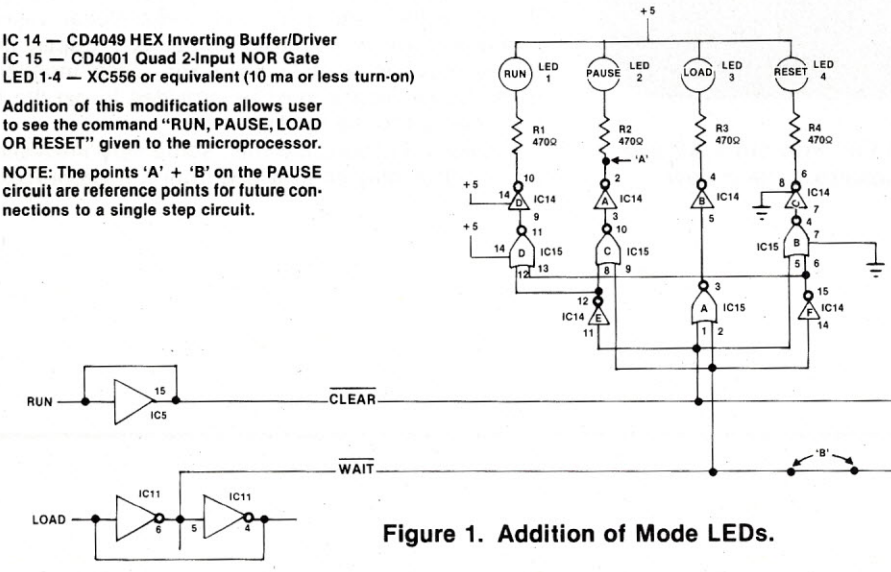
When the RESET mode is entered, the WAIT line goes high, causing IC 15 pin 3 to go low, turning off our PAUSE LED. IC 14 pin 5 again goes low, giving IC 15 pin 6 a low, causing IC 15 pin 4 to go high, causing the RESET LED to turn on by grounding through R4 from IC 14 pin 6.

Now a glance will tell at once what mode the processor is in.□

IC 14 — CD4049 HEX Inverting Buffer/Driver
IC 15 — CD4001 Quad 2-Input NOR Gate
LED 1-4 — XC556 or equivalent (10 ma or less turn-on)

Addition of this modification allows user to see the command "RUN, PAUSE, LOAD OR RESET" given to the microprocessor.

NOTE: The points 'A' + 'B' on the PAUSE circuit are reference points for future connections to a single step circuit.



MODE	$\overline{WAIT}$	$\overline{CLEAR}$
RUN	1	1
PAUSE	0	1
LOAD	0	0
RESET	1	0

Figure 1. Addition of Mode LEDs.

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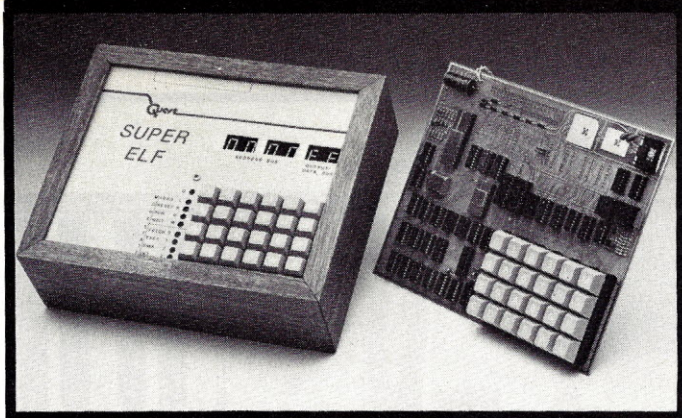

QUEST Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Tiny Basic, ASCII Keyboards, video character generation, etc.**

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are shown on several LED indicator lamps.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, input, memory protect, memory select, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector for PC cards and a 50 pin connector for the **Quest Super Expansion Board**. Power supply and sockets for **all** IC's are included in the price plus a detailed 90 page instruction manual.

Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and research and development.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Hardwood Cabinet** with drilled and labelled front panel **$24.95. NiCad Battery Backup Kit $4.95.** All kits and options also come completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year. New 100 page software manual Vol.1 $4.95.

Tiny Basic for ANY 1802 System

Cassette $10.00. On ROM Monitor $38.00. Super Elf owners, 30% off. **Object code listing or paper tape with manual $5.50. Original ELF Kit Board $14.95.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed** ($12.00 value). EPROM can be used for the monitor and Tiny Basic or other purposes.

A IK Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatible cassette file) another exclusive from Quest. It includes register save and readout, block move capability, and video graphics driver with blinking cursor. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. A Godbout 8K RAM board is available for $135.00. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $12.50 for easy connection between the **Super Elf** and the **Super Expansion Board.**

The **Power Supply** for the Super Expansion Board is a 5 amp supply with + 8v ± 18v + 12v − 5v. Regulated voltages are ±5v & +12v $29.95. −12 volt optional. Deluxe version includes the case at $39.95.

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7410N	.17	LM379	5.00	CD4527	1.51	8251		8.50
7414N	.63	LM380N	1.00	CD4528	.79	8253		10.00
7420N	.17	LM381	1.60	CD4553	5.75	8255		9.25
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7445N	.69	LM723H/N	.50	CD40192	3.00	CDP1802D		25.00
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7448N	.69	LM741CH	.35	74C04	.33	6820		9.95
7450N	.17	LM741N	.25	74C10	.28	6850		12.95
7474N	.29	LM747H/N	.62	74C14	2.10	6502		12.50
7475N	.49	LM748N	.35	74C20	.28			
7485N	.88	LM1303N	.82	74C30	.28	**IC SOCKETS**		
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7490N	.43	LM1305	1.27	74C74	.75	**PIN 1UP PIN 1UP**		
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74150N	.95	LM3905	1.75	74C906	.75	**WIRE WRAP LEVEL 3**		
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74157N	.69	NE5403	2.89	74C923	5.50	16 .33 28 1.00		
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		75491CN	.50	8T23	3.10	N82S131		3.75
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74LS14N	.90	LD130	9.95	2101-1	3.95	**CRYSTALS**		
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74LS33N	.39	**CMOS**		2107B	4.95	10 MHz		4.25
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LM320T-8	1.60	CD4070	.40	7205	16.50	2N2904A		.20
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LM340K-8	1.10	CD4078	.40	MM53104	2.50	2N3906		.18
LM340K-12	1.10	CD4081	.21			2N3055		.69
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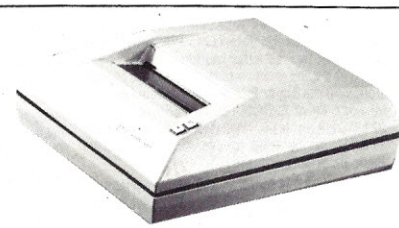

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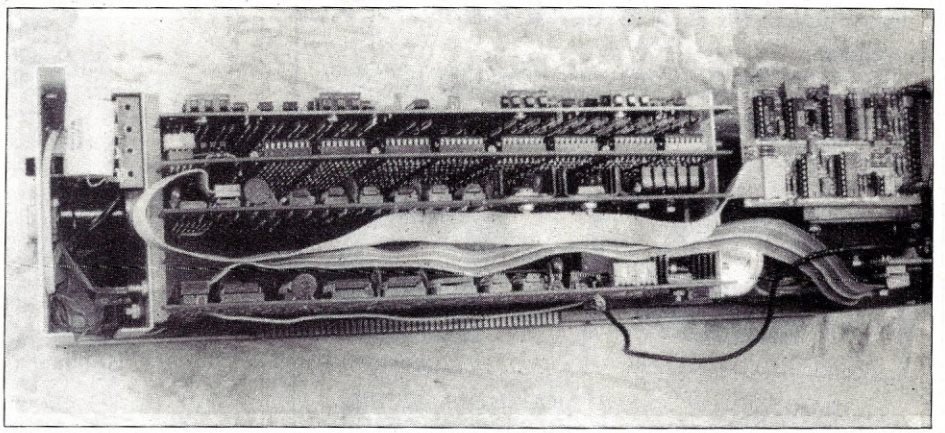

By Dr. Alfred A. Adler

PHOTO 1 Top view of Poly 88 with cabinet top and sides removed. Solid front wall of cabinet can be seen at left with fan immediately behind, followed by front card guide support, boards, rear card guide support, and horizontally oriented cassette minicard with transformer below it, both mounted to rear cabinet wall.

Many computer manufacturers do not do a very good job of providing for cooling of their equipment. Modifications made to the Poly 88 which greatly improved its cooling are described in considerable detail. Modifications which have been made to the Imsai 8080 are described, along with further modifications which could be made if necessary.

Certain analogies between fluid flow, and therefore the flow of cooling air, and the flow of electrons are pointed out. This enables the electronics-oriented reader to visualize deficiencies and plan modifications to his particular model computer.

One of the first things noticeable about a Poly 88 after it was up and running was how hot the top of the cabinet became after a rather short period of running. It was obvious how hot the components inside were running and what that might do to the life of the integrated circuits. After inspecting the cooling arrangements, including the Poly Fan Option, it became clear that with the application of a little aerodynamic theory the situation could be very greatly improved.

A few hours of closing holes in the cabinet that never should have been put in, opening a few new ones, and generally rerouting the internal air flow gave a very much cooler running computer. With the exception of the rear wall of the cabinet which was kept quite hot by the transformer, the rest of the cabinet remained cold to the touch even after ten to twelve hours of running.

Recent examination of several cooling arrangements of the more popular computers showed that, for most of them, a little more thought in the design stage would have resulted in a vastly cooler running machine. Fortunately, anyone can make modifications in a few hours that will certainly increase the well being and longevity of the computer.

The poor cooling performance of many computers is generally caused by one or more of the following design oversights: failure to provide a clear inlet for the cooling air, failure to provide a clear outlet, placing blockages or turns in the flow path, or not correctly proportioning the resistance between multiple flow paths. In addition, it always helps if the flow direction coincides with the direction of the natural convective flow instead of opposing it as so many do.

Since most of the readers are presumably more familiar with electronics than with fluid flow, clarity would be gained by pointing out that there is a very close analogy between the flow of a fluid such as air or water and the flow of electrons. For example, a power source such as a fan has the job of creating a pressure difference which causes flow from high pressure to low pressure, analogous to a voltage source. The less the flow is obstructed by solid objects which must be cir-

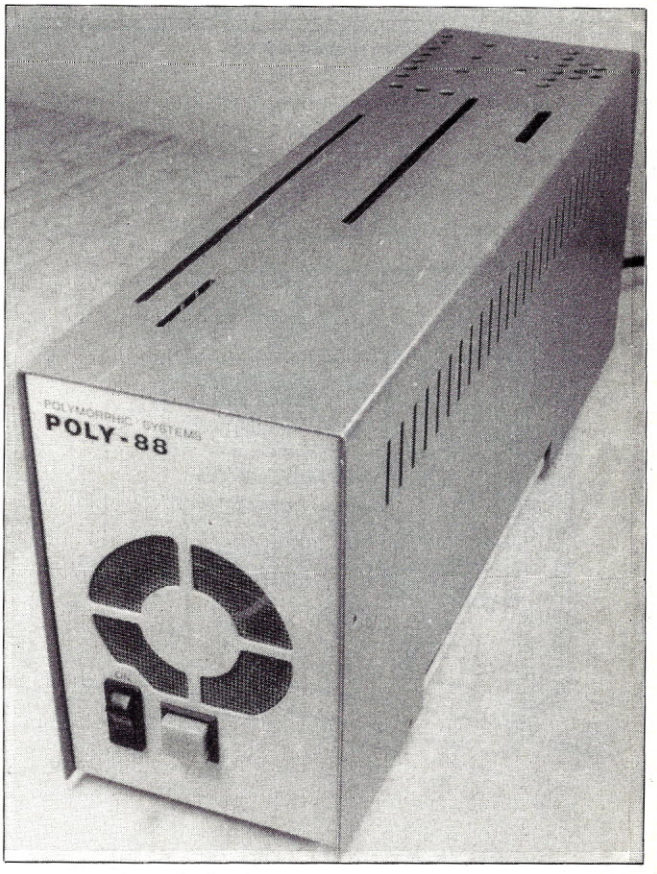

PHOTO 2 Front top view of Poly 88 cabinet showing the original rather ineffective cooling slots in the side walls. The openings in the cabinet front and top were made by the author to permit the flow of cooling air.

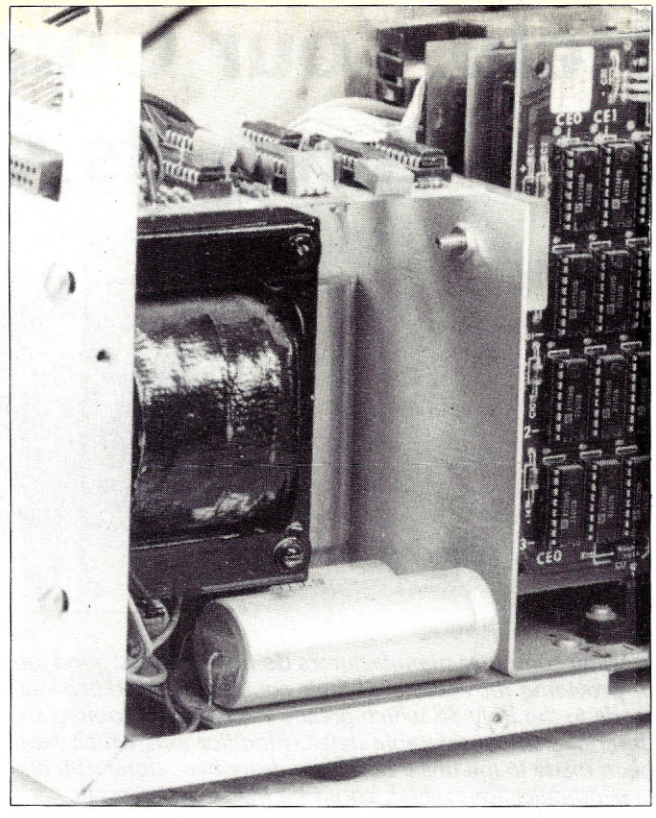

PHOTO 3 View of rear card guide support of Poly 88 as supplied by manufacturer with no provision for transmission of cooling air. Transformer can be seen with horizontally oriented cassette minicard above it.

cumvented, or by turns which add greatly to the resistance, the greater will be the rate of flow, analogous to Ohm's law.

To carry the analogy further, resistance to air flow such as obstructions or turns combine additively, whereas providing several parallel paths reduces total resistance but divides the current so that each path gets less air flow.

All these phenomena are directly analogous to DC principles. If the fan is considered to be a voltage source, openings in the cabinet as current sources or sinks, and flow paths as series or parallel resistors, it should not be difficult to determine what the cooling problems are and what is required to improve the situation. In the event that no fan is present, the only force driving the system is convection, that is the rise of the heated air due to its reduced density. Under these circumstances the outlet holes for the heated air should be located in the cabinet top directly above the sources of heat — usually heat sinks.

Examination of Photos 1, 2 and 3 show some of the difficulties encountered with the Poly 88. Photo 1 shows the fan placed immediately behind the front wall of the cabinet, which is without holes. From where is the fan supposed to draw its supply of air? The fan is well placed relative to the boards since, given a supply of air, there is a clear path down the length of the cabinet between the boards. Once the air has passed over the boards, however, it again encounters a solid wall (see Photo 3).

Behind the solid plate that supports the rear card guides are the transformer and two small PC boards. Since there is no way for the air to pass through or around the rear card guide support, the two PC boards are left to their own devices to be cooked by the transformer. The cabinet comes with a row of slots in the upper side walls and an opening at the bottom on each side adjacent to the motherboard (see Photo 2). These slots and openings, however, accomplish nothing since by actual test, with or without the fan, there is negligible air flow through them, either in or out.

As originally conceived by the manufacturer, the fan accomplishes nothing further than stirring up the air inside of an essentially closed box. Obviously for cooling to occur there must be a net outflow of heat from the box, and this requires a net inflow of cool air. This in turn requires air inlets and outlets properly placed to maximize heat pickup and minimize air flow resistance.

Since the fan in the Poly 88 is arranged to blow air across the boards (as opposed to exhausting air from the cabinet), a large hole was opened in the front of the cabinet to permit inflow of cool air (Photo 2). Since the primary sources of heat on the boards are the heat sinks and since heated air will rise, slots were opened in the top of the cabinet above each heat sink (Photo 2). These modifications alone were sufficient to provide excellent board cooling.

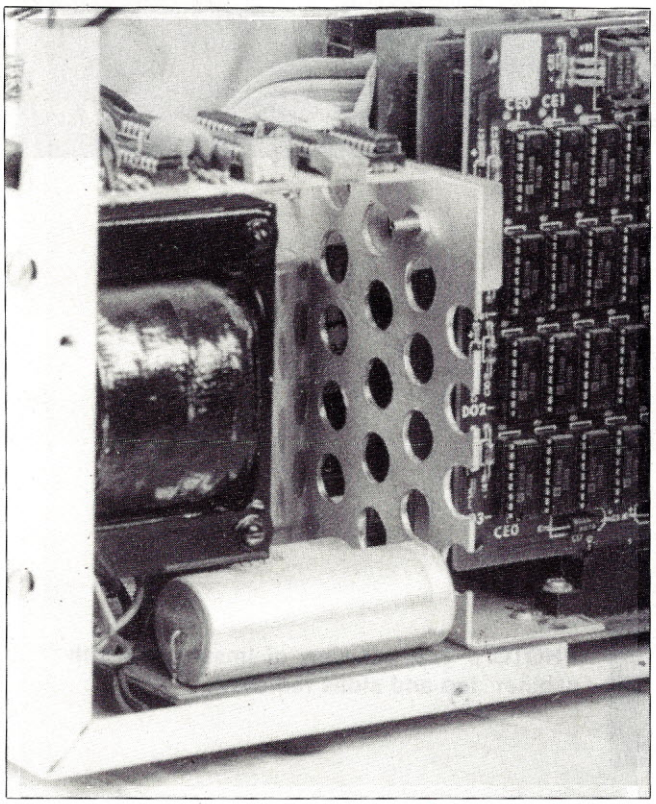

PHOTO 4 View of rear card guide support of Poly 88 after holes were added by author.

In an attempt to cool the transformer compartment, rows of large holes were drilled in the plate which supports the rear card guides to allow the air flow ot pass through this plate into the rear compartment (Photo 4). Holes were then drilled in the cabinet top above the transformer to allow this heated air to escape.

Unfortunately, the cassette board is placed directly above the transformer and oriented horizontally, thus providing considerable resistance to the heated air rising from the transformer and placing the board in an ideal position to be thoroughly cooked (Photo 3). A vertical orientation for this board would have been far better. However, making such a change would require major surgery on the cabinet and has not been done.

Since the transformer is bolted to the rear wall of the cabinet, it would not be difficult to simply turn it around and, using the same bolt holes, fasten it to the other side of the rear wall. This would place it outside the cabinet where it could create its own convective updraft, not contribute to the heat load inside the cabinet and in particular not cook the cassette board.

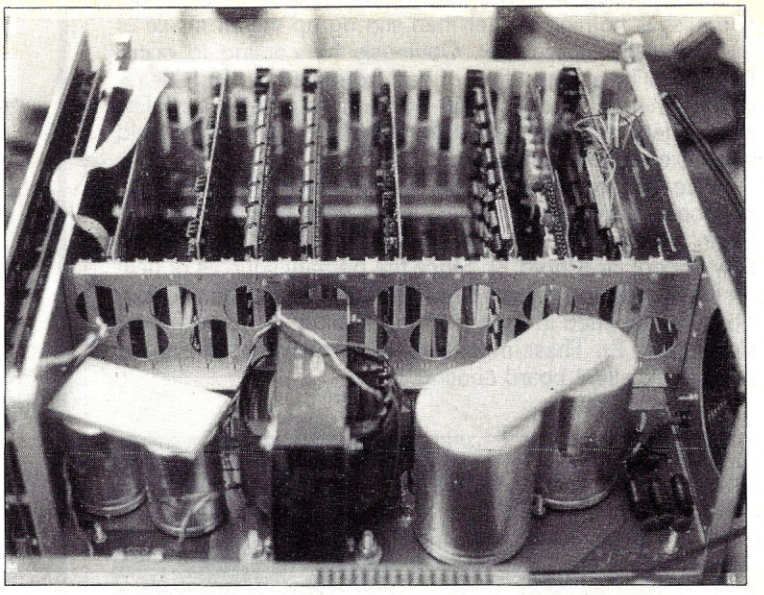

PHOTO 5 View from right side of Imsai 8080 with cabinet top and sides removed.

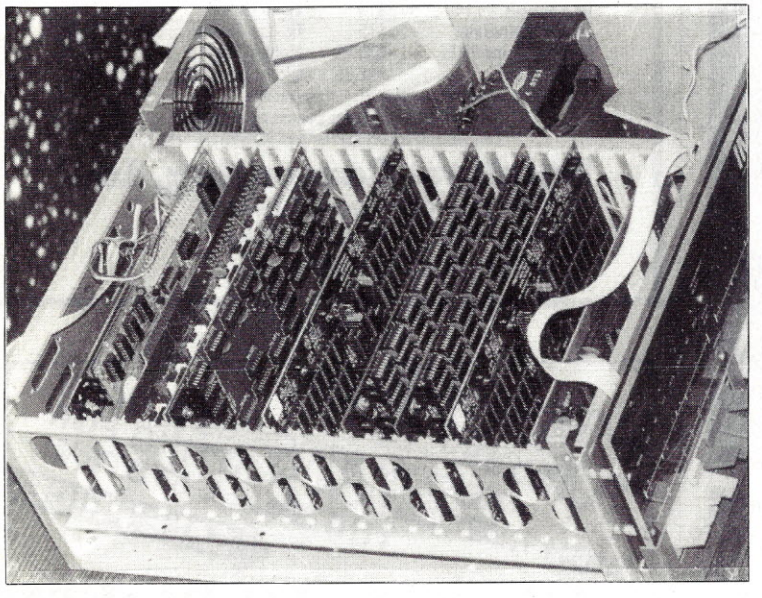

PHOTO 6 Top left view of Imsai 8080 with cabinet top and sides removed.

Problems of a different nature are apparent in Photos 5 and 6, which show a top view of an Imsai 8080 with the cabinet cover removed. This cabinet cover has cooling slots along the upper portion of the side walls similar to those of the Poly shown in Photo 2. The fan in the Imsai pumps air into the region behind the transformer and then into the region ahead of the transformer. The flow is supposed to proceed to the board sections and then out through the left side of the cabinet.

To a limited extent this does occur; however, the lowest resistance pathway out of the region behind the transformer is through the slots in the rear right hand cabinet wall. Unfortunately, an undue amount of air follows this path, doing nothing useful along the way. Obviously the first step toward improvement is to block the air flow through the right rear side wall, thus forcing the air to leave the cabinet by a more useful route.

Now notice that the transformer is large enough to substantially block flow into the forward part of the right hand compartment from the rear part. Assuming that the right rear side wall openings have been closed, cooling air will now flow freely across the rear boards and out through the rear left hand cabinet wall? But what about the front boards? Since the transformer prevents the forward right hand compartment from being a high pressure region, little flow is induced across the forward boards.

There are a number of remedies for this. First of all, the holes in the forward right side cabinet wall must also be blocked to force air to flow over the boards instead of going out through the right wall. Next, the holes between the rear board section and the rear transformer section could be lightly blocked to force more air forward. Optionally, the slots in the left rear side wall of the cabinet (not shown in Photo) could be lightly blocked (block half of alternate slots), and the slots in the forward left side wall should be opened progressively larger from rear to front, at least doubling or tripling slot area at the very front. This should induce considerably more flow through the forward board compartment.

These modifications are sufficient for the moment since only six boards are in use. As more boards are added, the heat load will increase, and it is expected that further alterations will be required. The cooling problems discussed above generally cover the spectrum of problems encountered and there should be no difficulty in applying similar modifications to other computers as necessary.□

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Speed Up Your 'Slow'

By William A. Ruggirello

At 300 baud it sure beats a teletype, but with this simple modification you can double that to 600 baud. This modification has been used on ten different units in the past two years with continuous operation and no problems have resulted at all.

The modification simply subsitutes a 9600 baud clock for the 150 baud clock now on the board. The 110 baud and 300 baud operations are still available as before.

The circuit is built up on a perf board and mounted onto the rear panel to an available stud to the left of the main PCB. One etch cut is made and the output lead soldered to the etch. The +5 volt and ground are obtained at the terminals to the rear of the main PCB.

To implement this modification build up and wire circuit as per layout and schematic. Mount circuit board as shown onto standoff. Cut etch going to pin 7 of E59 on the top side of the main PCB. Connect the +5 volt and ground wires from main PCB. Attach output wire from circuit board to pin 7 of E59. Adjust pot for an output frequency of 9600 Hz. Select 150 baud on the DECwriter II front panel.

Stand back. Isn't speed wonderful?□

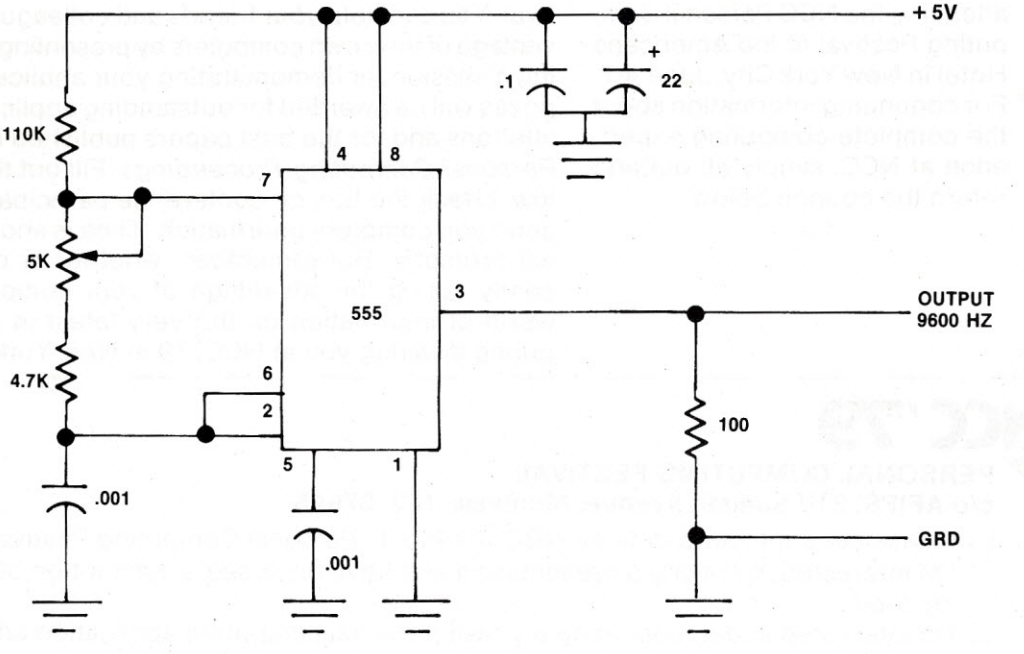

Figure 1. Circuit Schematic

DECwriter II

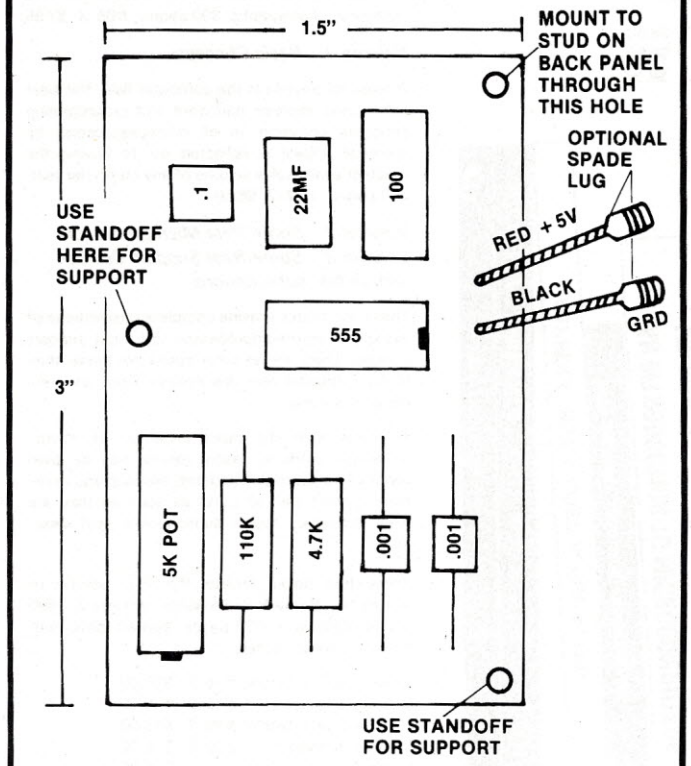

Figure 2. Perf Board Outline

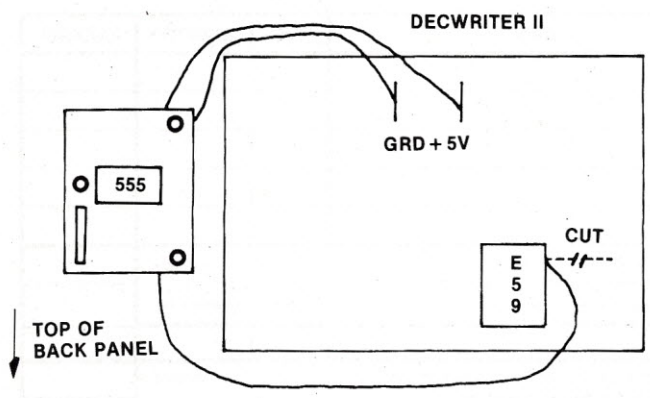

Figure 3. Interconnection Outline

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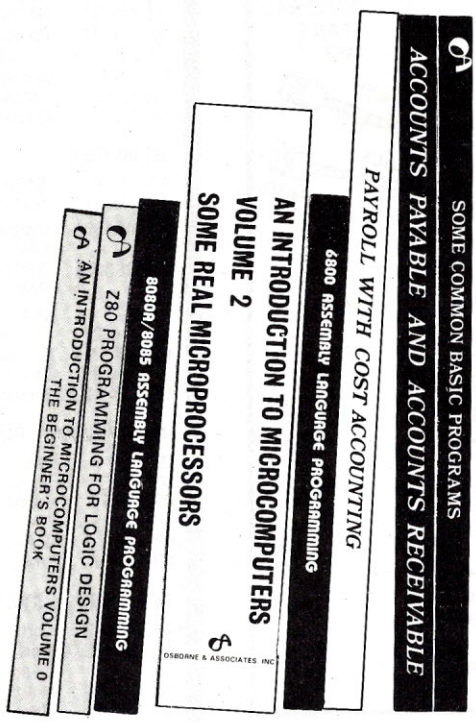

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PROGRAMMERS CONTEST

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The prizes include: a two-year subscription to INTERFACE AGE and the publication of your game paid at the prevailing author rates.

HERE ARE THE RULES:

- The game must be written in assembly code for any machine of your choice.
- The game must include all the prime characters in the television show.
- The game cannot be based around ships shooting ships.
- The game can utilize graphics at the start and throughout the game.
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Each submitted game will be judged on creativity, coding style, clarity of the game instructions, and how the code works.

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All submittals must be received at the INTERFACE AGE editorial offices not later than April 1, 1979. Each submittal must be accompanied by a self-addressed stamped envelope and an IAPS formatted tape of the code. The tape must contain both source and object code. The article must be in the format described on page 32a of the March 1978 issue.

Send your entry to Carl Warren, Editor-in-Chief, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, California 90701. Please no phone calls.

BOOK REVIEWS

ERRORS IN EXPERIMENTATION

By Carl W. Hall. Matrix Publishers, Inc.

Review by Roger H. Edelson, Hardware Editor

This book is not really intended for the average computer hacker. It is more properly directed to the serious experimenter in any of the sciences. While the discussion would seem to apply only to the physical sciences, the need to identify, understand, and control errors in all sciences where the observation of process is involved is equally important.

The author begins the book by defining errors into various categories which Figure 1.1 from the first chapter of the book illustrates very effectively. The reader should note that even blunders and mistakes are assigned a place in this figure (albeit illegitimate).

The book covers the techniques and approaches of experimental procedures, and then spends the next four chapters discussing the various types of errors and how they arise. Data representation and analysis is covered, followed by chapters on probability and error analysis. A cursory set of chapters covers measurement and control systems (mainly various mathematical transformations) and instrument and controller response. The book concludes with a brief (five-page) coverage of reliability.

The author's style is lucid and clear, and the reader is not overly burdened with mathematical complexity. The book does an effective job of covering the subject of errors and is worthwhile reading for anyone involved in experimentation and data gathering.□

HOME COMPUTERS: A BEGINNER'S GLOSSARY AND GUIDE

By Merl K. Miller and Charles J. Sippl. dilithium Press.

Review by Roger H. Edelson, Hardware Editor

I really don't care much for glossaries. My feeling is, "It's got a great cast of characters but not much plot." In the case of this glossary, however, at least five chapters are devoted to plot: notes on home computers, introduction to home computers, a discussion of memories, and a chapter on number systems. These chapters do provide the novice with an introductory guide to the home computer. The last chapter contains a number of the more common symbols to be found in the field of electronics but not enough logic to do any good (or any harm either).

Returning to the glossary which is, after all, the major portion of the book, we find that my opinion still hasn't changed significantly. From the standpoint of the beginner, this glossary isn't bad, but it really doesn't cover enough. Some of the definitions are incomplete. Witness the definition of a Zener diode as "a diode with a low resistance where current is a function of the external circuit resistance. It is used to regulate voltage." Some are rather inconsistent; most of the definitions of virtual fall into this class. Some, i.e. Exclusive Or, are tortuous to decipher. The discussion could better be served by the inclusion of a simple truth table.

Part of my problem undoubtedly stems from the fact that I'm no longer a beginner in the field, and it is difficult to review this book from that position. In general, it probably does a reasonable job of introducing the beginner to the field, and that is really all it claims to do.□

TAKE A CHANCE WITH YOUR CALCULATOR

By Lennart Rade. dilithium Press

Review by Roger H. Edelson, Hardware Editor

This book is almost exactly what its subtitle suggests: a group of probability problems for programmable calculators. In all cases the problems are solved by simulation through the use of a random number generator or a spinner simulation. Nowhere does formal probability theory show up.

On the first page we are introduced to a random number generator which produces four random digits at a time by taking the first four digits of a decimal number x_1. The generating formula for X_1 is $X_1 = \text{FRAC}(147\ x_0)$, where x_0 is a decimal number between 0 and 1 with at least five decimals. This is the so-called "147 generator" because of the 147 multiplier. However, no theory is introduced to explain this generator. There are other problems as one continues.

While there is some use for simulation as a means of studying, or solving, certain probability problems, a 163 page book is not necessary. Further, the last section is devoted to programs of all the exercises in the book. The introduction indicates that the programs will work for the H-P 25 and the TI56 calculators. However, H-P uses RPN (Reverse Polish Notation) entry, and TI uses an algebraic system utilizing parenthesis. This being the case, it really appears that the programs are written only for the H-P 25.

The commentaries in Part 2 do provide more insight into the uses of simulation, but on the whole the book is inadequate.□

PROGRAMMABLE CALCULATORS: BUSINESS APPLICATIONS

By J. Aronofsky, R. Frame and E. Greynolds, Jr. McGraw-Hill

The authors state that this book stems from their experience in teaching the use of programmable calculators to business executives and students at Southern Methodist University. It is almost wholly concerned with programming the Texas Instruments TI-58 and TI-59 calculators, although other TI programmables are covered in an Appendix and some programs are included.

Assuming that readers are already familiar with some fundamental principles of busi-

ness math, the book concentrates on teaching programming concepts. Each section gives short program examples to illustrate one or more of the TI 58/59 functions and emphasizes the underlying idea (such as "looping using counters") which could be applicable to computers as well as calculators. There are also chapter objectives and exercises to make sure the concept gets across.

This approach is far more systematic than that taken in the TI 58/59 owner's manual. And the idea of using a sophisticated yet relatively inexpensive programmable calculator to learn material normally covered in a first semester computer course should catch on. Unfortunately, Aronofsky, Frame and Greynolds fall down badly in never attempting to consider program efficiency or to cover the elusive but all-important precepts of "style" which can best be taught by example rather than dictum. Almost all the program examples given in the book are either perfunctory or ill-considered.

In teaching the use of parentheses early in the book, for example, the authors give a keystroke routine which contains a superfluous parenthesis before a closing equals sign. This usage, which continues throughout the book, is symptomatic of failure to deal in any depth with an algebraic operating system, or more generally with machine implementation of a chained-operations hierarchy.

By the time we reach the "Advanced Programming" chapter near the end of the book, we encounter a program to compute the present value of 10 unequal cash flows at a 10 percent interest rate, which is written so that finding the present value of 11 cash flows at an 8 percent rate would require modifying the program itself rather than simply entering new data. Even a very novice programmer might be inclined to quibble.

The flaws in this book seem to stem largely from the authors' attempt to spoon-feed elementary programming concepts while ignoring any that might require the reader to stop and ponder. The chapter exercises reflect this approach; they may require some thought, but never any judgement.

As a supplement to the TI 58/59 owner's manual, this book has some merit for beginning programmers. It could also serve as a text for a mini-course in calculator programming or a supplementary text in a business math course, assuming that a teacher could provide those elements which the book lacks. However, the idea of a self-study calculator programming book teaching concepts which could later be applied to computer programming has been suggested but not fulfilled by this book.☐

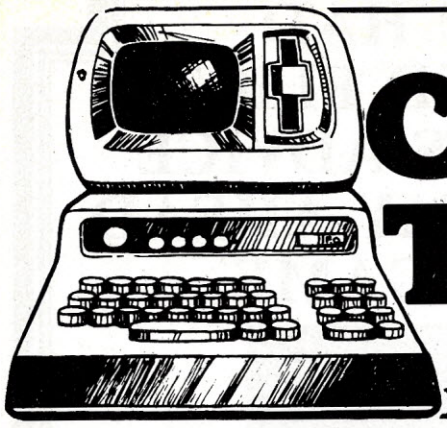
THE Z-80 MICRO-COMPUTER HANDBOOK

By William Barden, Jr.

Howard W. Sams & Co., Inc.

Review by Roger H. Edelson, Hardware Editor

The purpose of this book is threefold: to acquaint the reader with the hardware aspects of the Z-80, to discuss in reasonable



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detail software instructions implemented in the Z-80, and to describe microcomputer systems built around the Z-80. This last section, only 30 pages long, could well have been left out. Because of the volatile nature of the hobbyist microcomputer market, coverage of specific systems is incomplete almost as soon as the book is published, so it is impossible to go deeply into any particular configuration without producing the operation manual for that microcomputer. The first two goals of the book, however, are met quite adequately.

Eight chapters are used to cover the hardware aspects of this microprocessor, starting from the device architecture to memory and I/O interfacing.

One whole chapter is devoted to flags and arithmetic operations, an area that is usually given short shift in other books. The Z-80 addressing modes and interrupt sequences are also presented in this section.

In Section II Barden covers the almost bewildering array of software instructions available to the Z-80 assembly language programmer. While floating point operations are never covered, decimal, 8-bit and 16-bit arithmetic is discussed. Bit manipulation and lists and table operations are also covered in two chapters.

Two more chapters are devoted to I/O and interrupt operations and subroutine instruction groups. The last chapter of this section presents commonly used Z-80 subroutines, i.e. timing loop, multiply/divide, multiple-precision arithmetic, table search, etc.

The Z-80 electrical specifications are presented in Appendix A. Appendix B compares the 8080 and Z-80 instruction sets. Other less interesting Appendices are also included.

This book does not exhaustively cover the Z-80 microprocessor, but the reader will definitely benefit from this informative volume and will receive valuable assistance in solving some of the hardware and software implementation problems he may face when using the Z-80. Barden writes with a clear expository style that is very informative and easy to follow. Altogether he has produced a quite useful book that deserves a place on the shelf of any hobbyist who contemplates the use of the Z-80.□

NCR — DATA COMMUNICATIONS CONCEPTS

Prepared by Technical Education Department, Marketing Education Division, The National Cash Register Co.
E&L Instruments, Inc.

Review by Roger H. Edelson, Hardware Editor

This volume is another in the continuing Bugbook® series of books that provide step-by-step instruction concerning basic electronic concepts. This volume explores the various concepts, techniques and limitations of data communications. Data communications concepts are covered mainly from the viewpoint of telephone transmission, and consideration of techniques more generally applicable to other communication systems are left out.

In one particular instance modulation, the topic of phase shift keying (PSK), is never mentioned at all, and in discussing Single Sideband (SSB) modulation, the phasing method of producing this type of modulation is not mentioned either.

Also promulgated is the erroneous view that SSB gives a 3 dB advantage in signal-to-noise ratio by virtue of its one-half bandwidth compared to standard AM. Unfortunately, if you reduce the bandwidth of a double-sideband signal, you reduce the received noise power by one-half. But the removal of one sideband also reduces the received signal power by one-half — a standoff. The book does point out the other advantages of SSB (with suppressed carrier): frequency conservation and the higher information power obtained from the elimination of the transmitted carrier.

These shortcomings aside, the reader is provided with a reasonable non-mathematical introduction to the concept of data communications. Introductory material on verbal and visual communications is followed by a discussion of telephone systems, circuit terminations, and system operating modes.

Intelligence signals are discussed along with the previously mentioned modulation methods and carrier systems. Bels and decibels are presented as a means of dealing with the logarithmic nature of hearing, and then their usefulness is expanded to cover the problems of data transmission. A survey of and means of correction of some transmission problems (attenuation, noise, crosstalk, echoes and delay) are presented in the next two chapters. The book then concludes with a discussion of modems and some quite useful appendices.

The writing is somewhat short and choppy, but the style remains readable and is not difficult to follow. The questions at the end of each section do provide good tests for the reader's understanding of the previously presented material.

The book will provide a good beginning insight into the basic concept of data communications and should be seriously considered by anyone interested in the field.□

A STEP BY STEP INTRODUCTION TO 8080 MICROPROCESSOR SYSTEMS

By David L. Cohn and James L. Melsa
dilithium Press

Review by Roger H. Edelson, Hardware Editor

According to the introduction, this is a book for "people who don't know anything about microprocessors but who wish they did." I'm afraid that after reading it, those people will still know little about microprocessors. On top of that, the statement that "Computer professionals will find the detailed treatment of the 8080 architecture and instruction set useful" is about as close to an outright fabrication as I ever hope to see. The "detailed treatment of the 8080 architecture and instruction set" consists mainly of Appendix A, titled an "Alphabetical Listing of Instructions," which could have been straight out of the 8080 data sheet except it does not contain as much information.

The major problem is that nothing is discussed in sufficient detail. For instance, only two pages of the introduction are used to cover typical applications, and the Flag Register is dismissed on page 37 by a description of the zero flag only. It is never mentioned again (or before).

The book uses chapters 2 through 4 to present machine structure through the eyes of some simple instructions. Chapter 5 is concerned with jump instructions and the page structure of memory is presented. Chapter 6 continues to examine memory, covering storage and retrieval.

Chapters 7 and 9 cover Monitors and Editors, respectively, and Chapter 8, in all of its 10 whole pages, is purported to present "a detailed investigation of the use of Teletype and Teletype-like terminals."

Advanced software techniques like Stacks and Subroutines are presented in Chapter 11. Interface devices are given even shorter shrift in the 8 pages of Chapter 13, while the authors feel that they can cover peripheral equipment in the 6 pages of Chapter 15.

At this point, warming to their task, the authors compare other various processors in the 8 pages of Chapter 16 with about one paragraph devoted to each.

If they threw out everything after Chapter 6 with the exception of Chapter 11, and did some heavy editing, it would be a good buy. As it is, I personally do not recommend it.□

CALL FOR ARTICLES

INTERFACE AGE is actively seeking articles in hardware, software and general applications of microcomputers in the areas of education, aid for the handicapped, the OEM market and grpahics.

Remuneration for accepted articles done by individuals ranges from $15 to $50 per published page. Articles describing company projects carry author and company byline, but no payment is offered. Submittals must include an abstract, outline and stamped return envelope.

Manuscripts should be typed, double-spaced with one-inch margins. They should run at least four pages (one published page). Pages should be numbered to ensure correct text. Photos should have the author's name and a description on the back. Tables, listings, etc. should be on separate sheets. Computer listings should be printed using a new ribbon to assure good reproduction. Authors shall supply a statement of their background, expertise and level of accomplishment.

The publisher assumes no responsibility for artwork, photos, models or manuscripts. No acknowledgement is made unless accompanied with an addressed, stamped return envelope.

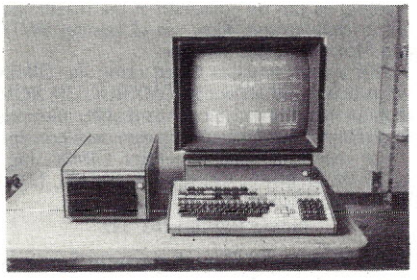
For article submission or further information contact the respective author at INTERFACE AGE Magazine, 16704 Marquardt Ave., Cerritos, CA 90701. Please do not call the office for information.

New Products Directory

MICROCOMPUTERS

CompuSlide Service

CompuSlide, Inc., a subsidiary of Simons Office Systems of Los Angeles, CA, is introducing its new microprocessor-based CompuSlide Service.



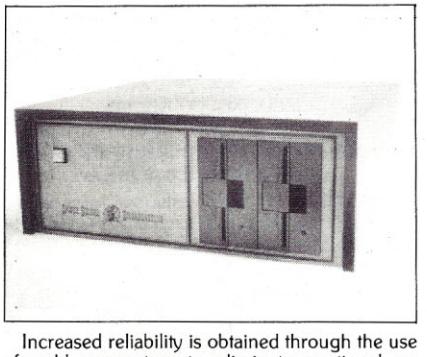
A CompuSlide customer buys or leases a small CRT terminal which he uses for inputting new and updated data for the regular charts he needs. CompuSlide provides a special prompting computer program which permits any staff person in management or accounting to input new slide information and transmit it to the CompuSlide service bureau using a standard telephone. There the slide is generated automatically by computer, film is processed and mounted, and the finished slides expressed back to the customer in 24, 48 or 72 hours, depending on his requirements.

For more information contact CompuSlide, Inc., 1801 Century Park East, Los Angeles, CA 90067, (213) 556-2447.

CIRCLE INQUIRY NO. 121

6800-Based Microcomputer

The new Smoke Signal Broadcasting CHIEFTAIN microcomputer is a versatile, general purpose system based on the powerful 6800 microprocessor with 32K of static RAM. Standard features also include two serial I/O ports, two minifloppies and the compatible DOS-68 disk operating system.



Increased reliability is obtained through the use of gold connectors to eliminate continual reseating of boards and a cooling fan to extend component life.

The new microcomputer allows up to 60K of usable memory by adding two more slots. Disk storage can also be increased to four minifloppies or four 8-inch floppies.

Price for the Chieftain is $2,595 retail. For more information contact Ed Martin, Smoke Signal Broadcasting, 6304 Yucca St., Hollywood, CA 90028, (213) 462-5652.

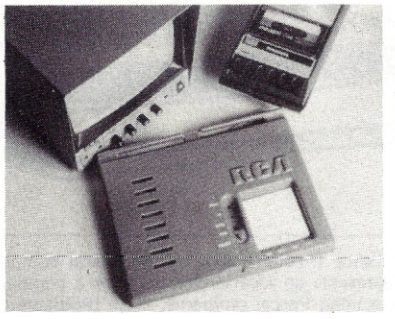
CIRCLE INQUIRY NO. 122

VIP Personal Computer

Priced at $249 fully assembled, the VIP is a complete computer on a printed circuit card, offering a powerful, uncluttered, complete operating system in only 4K bits of ROM.

VIP's output directly interfaces with a monochrome CRT display or, when used with an FCC-approved modulator, a TV receiver. Programs can be generated and then stored in an audio cassette tape recorder for easy retrieval and use.

The VIP features a single 8½x11" PC card with the CDP1802 microprocessor, 2,048-byte RAM using 4K-bit static RAMs, single-chip graphic video display interface, built-in hexadecimal keyboard, 100-byte per second audio tape cassette interface, simple wall-plug regulated power supply, and easy expandability for both memory and I/O interfaces.



The easy-to-follow hobbyist's manual contains detailed information on VIP operating procedures, CHIP-8 interpreter programming technique, machine language programming, logic description, test programs and trouble shooting guides, and VIP system expansion instructions.

For more information contact RCA COSMAC VIP Marketing, New Holland Ave., Lancaster, PA 17604, (717) 291-5848, Rick Simpson.

CIRCLE INQUIRY NO. 123

Micro-Slice Single Board Communications Computer

Micro-Slice is a complete Z80A-based communications computer on a single S-100 board for OEM, business, and hobbyist applications, offering:

- A 4mhz Z-80 module, with power-on jump to any 256-byte boundary, 8 software prioritized interrupt inputs, and a real-time clock
- Up to 8K of ROM (2-2708,2716,2732), dip switch mappable to any 4K/8K boundary
- 2K static RAM (2114), dip switch mappable with the ROM to any 4K boundary
- An asynchronous/synchronous serial port with 16 software-selectable baud rates (50-19.2K), software selectable parity, stop bits, and number of data bits, full or half duplex operation
- Two fully buffered bi-directional parallel ports, common output buffer, dip switch mappable as the 1st and 2nd ports of any 4-port boundary
- Four bi-directional USART control ports, 2 real-time clock control ports, 2 single bit status ports
- Slave mode operation, permitting multiple Micro-Slices to run on the same bus under one CPU
- Front panel software, with examine, deposit, call, input, output, jump, block transfer and search commands and USART initialization
- Fully buffered bus drivers

Price is $349 kit, $395 assembled and tested. For more information contact Micro Diversions, Inc., 8455-D Tyco Rd., Vienna, VA 22180.

CIRCLE INQUIRY NO. 124

Vector Graphic Introduces Dual-Floppy, Z-80 Based Microcomputer

A new high-performance low-cost microcomputer, featuring two Micropolis quad-density floppy disks has been introduced by Vector Graphic Inc., designers and manufacturers of computers and peripherals for the hobby and small business markets.

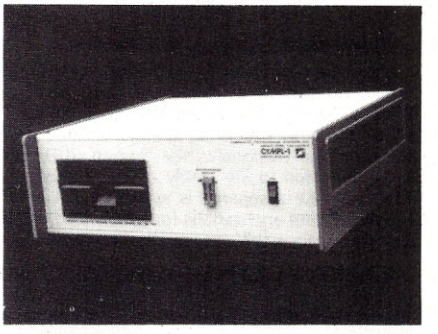
The new Vector MZ is a versatile general purpose byte oriented digital computer based on the powerful Z-80 microprocessor and industry standard S-100 bus. Outstanding features include the Z-80 CPU with 158 basic machine language instructions and a minimum instruction cycle of two microseconds. An 18-slot motherboard provides flexibility and expansion capabilities for up to 64K of directly accessible memory using a parallel 8 bit word/16 bit address. Up to 256 separate input and output devices can be addressed.

Price for the Vector MZ is $3750 (single disk version available for less than $3000) and may be purchased at all authorized Vector Graphic dealers. For more information, contact Yvonne Beck, Vector Graphic Inc., 790 Hampshire Rd., Westlake Village, CA 91361, (805) 497-6853.

CIRCLE INQUIRY NO. 125

CYMPL-1™ PAL® Design System

CYMPL-1 is a low cost, stand alone system for designing, documenting and programming PAL integrated circuits. All communication to and from the user is with English-like statements through a CRT or hard copy terminal.



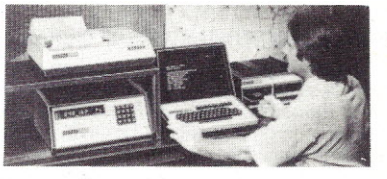
CYMPL-1 will translate Boolean equations directly into PAL fuse patterns, and will display the resulting fuse pattern on the terminal. Upon command, the fuses in a new PAL device will be blown according to the pattern. Alternatively, CYMPL-1 will read the pattern from a previously programmed PAL, and program new PAL devices according to this previous pattern, without the use of equations.

CYMPL-1 comes with complete software which includes operating instructions and a library of implemented TTL functions on a diskette. For more information contact Cybernetic Programming Systems, Inc., 175 Jefferson Dr., Menlo Park, CA 94025.

CIRCLE INQUIRY NO. 126

Heath Announces Assembled Computers

From Heath Company, comes word that most major Heath Computer products are now available in assembled as well as kit form.



Computer products available in assembled form include the WH8 8-Bit Computer and its associated memory and interface boards, the WH17 Floppy Disk System for the WH8, the WH11A 16-bit Computer and associated memory and interface boards, the WH27 Floppy Disk System for the WH11A, and the WH14

Line Printer designed for use with either computer system.

For more information send for a free copy of the latest Heathkit catalog. Write Heath Company, Department 350-830, Benton Harbor, MI 49022.

CIRCLE INQUIRY NO. 127

Communicating Computer

The ENVAX Series by Vardon & Associates adds intelligence to any standard data terminal and provides direct communication ability via its own on-board modem to public and private networks.

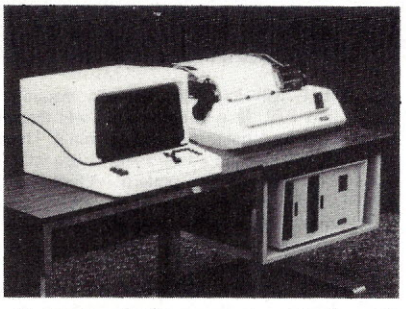
Intelligence for the ENVAX comes from its Programmable Read Only Memory (PROM), of which 32K PROM is available. Approximately 6K PROM has been programmed for a set of instructions allowing operator prompting, text editing, and handling of various communication functions. This block of preprogrammed PROM which includes several other functinos, such as automatic time and date insertion at the end of transmission and auto dial and re-dial, is offered with the standard unit. Encryption, under software control, provides security of data during transmission. By issuing a simple command via the keyboard, the operator instructs ENVAX to scramble data for confidential messages.

For more information contact Vardon & Associates, Inc., 930 North Beltline, Irving, TX 75061, (214) 252-7502.

CIRCLE INQUIRY NO. 128

Desktop Computer System

Interactive Computer Systems, Inc., New York, has announced the availability of a new desktop computer system offering an APL language interpreter and virtual memory storage utilizing flexible diskettes. Designated the System 900, this newest addition to the family of MCM products offered by the company, is available with a full line of software applications for accounting, word processing, financial and technical applications.



The System 900 incorporates a desktop computer with user memory to 24K bytes, complemented by up to 256K bytes of virtual memory on floppy disk. In addition, the MCM 900 operates at speeds of five to six times the speed of its predecessor, the MCM/800.

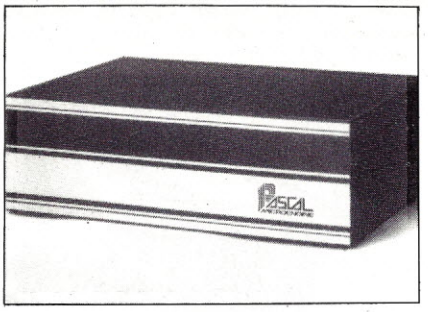
Prices for the MCM 900 desktop computers start at $9,300. Complete systems available from $15,000. Delivery is 30-60 days ARO. For more information contact Interactive Computer Systems, Inc., 310 E. 46th St., Suite 16W, New York, NY 10017, (212) 697-6906.

CIRCLE INQUIRY NO. 129

Pascal MICROENGINE™ Computer

Western Digital announces a new Pascal Computer System driven by an LSI innovation: The 16-bit Pascal MICROENGINE — the first microprocessor hardware designed for direct high-level language execution.

Programs written in the block-oriented Pascal language are compiled into an intermediate code (called P-code) which is directly executed by the Pascal MICROENGINE, a 16-bit stack-oriented Pascal processor consisting of four high performance LSI components developed by Western Digital. The processor is incorporated into the single board microprocessor which directly executes user Pascal programs and the University of California at San Diego (UCSD) Pascal Operating System, Release 3.0.



Since P-code output by the Pascal compiler represents an ideal architecture for a computer executing Pascal programs, these programs execute up to five or more times faster than equivalent systems using software interpreters.

For more information contact Western Digital Corp., 3128 Redhill Ave., Newport Beach, CA 92663, (714) 557-3550, Extension 335, Ed O'Neil, Marketing Manager.

CIRCLE INQUIRY NO. 130

"The System" from MicroDaSys

At $549 (kit) the MicroDaSys System 1 is truly one of the best buys on the market. The system features our custom console, keyboard, S-100 bus motherboard, 16 amp power supply, fan, 64x16 upper and lower case video/graphics card, and the MD-690A CPU board. The assembled price is $699.

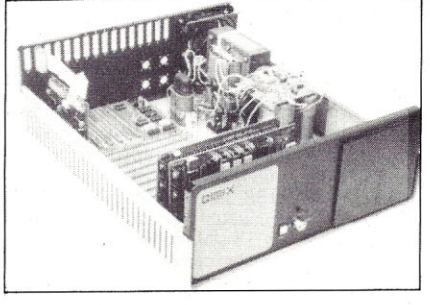
Besides combining the 6800 processor (6802) with the S-100 bus, the MD690A is truly a system on a board. Features include a 2400 baud cassette interface, 10K PROM space, 1K RAM, 20 I/O bits, an RS-232 interface, and interrupt driven keyboard input. This CPU is as flexible as state-of-the-art should be, permitting the user such options as putting 8K BASIC in on-card PROM, multitasking and timesharing. There is even 2400 Hz real-time clock circuitry provided.

For further information contact MicroDaSys, P.O. Box 36051, Los Angeles, CA 90036, (213) 935-4555.

CIRCLE INQUIRY NO. 131

GIMIX Delivers System 68

GIMIX Inc., the company that manufactures telephone industry products and Ghost® power control systems, is delivering its complete professional quality system 68 microcomputer.



It features a ferro-resonant constant voltage power supply; an SS50 motherboard (15-50 pin and 8-30 pin gold plated slots); a 6800 CPU board that holds 4-2708s and 3 independent programmable software timers; and the unique GIMIX 16K software readdressable static RAM boards organized into 4 separately controllable 4K blocks, which allow the user to have as much memory as can be contained in the mainframe. DIP switch features allow use of existing SWTP and MSI compatible software.

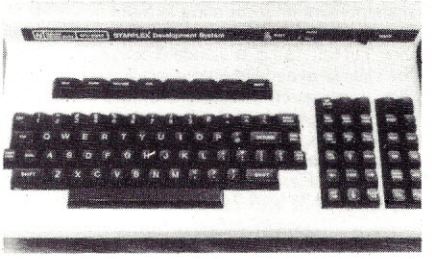
This system is video based using the GIMIX video board and advanced GMXBUG 3K ROM monitor that contains the standard utility functions plus routines that facilitate software development.

For more information contact GIMIX, Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 927-5510, Richard Don.

CIRCLE INQUIRY NO. 132

Disk-Oriented Development System

A new interactive, microcomputer development system, with fully integrated hardware/software and high-level languages, dramatically cuts microprocessor system hardware and software development time.



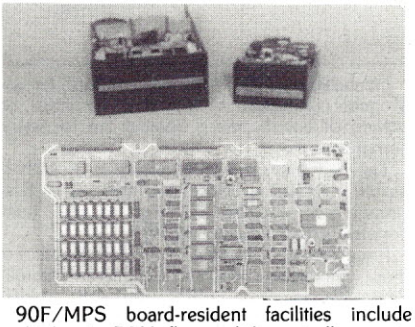
Called the STARPLEX™ Development System, it is designed specifically to provide the functions needed in a systems-development environment for 8080A microprocessors and series /80 microcomputer boards and systems. Integrated hardware and software provides the key to the improved human engineering aspects of this system.

Price is $13,800. For more information contact National Semiconductor Corp., Computer Products Group, 2900 Semiconductor Dr., M/S 465, Santa Clara, CA 95051, John Jones.

CIRCLE INQUIRY NO. 133

Single Board Microcomputer with Floppy Disk Controller

The 90F/MPS microcomputer is a single board IEM product, based on the Z-80 microprocessor family.



90F/MPS board-resident facilities include multi-density DMA floppy disk controller, up to 65K bytes dynamic RAM, up to 14K bytes of ultraviolet erasable PROM with programmer, 1K byte of static RAM, up to four 8-bit programmable I/O ports (two Z80-PIOs), four programmable counter/timer channels, an RS232C or 20 mA serial port with selectable baud rates, 2.5 or 4MHz operation and PROM-resident system monitor with debug capabilities.

Single unit price with 16KB dynamic RAM and two parallel ports is $1,295. Delivery is 30-45 days ARO. For more information contact Quay Corp., P.O. Box 386, Freehold, NJ 07228.

CIRCLE INQUIRY NO. 134

Desk-Top Computer Speaks BASIC

Both scientific and business users will benefit from the compact, powerful Compucorp 625 Mark II Desk-top Computer. In a single packae this computer incorporates the display, memory and hard-copy peripherals that are usually packaged separately.

Based on a Z-80 central processor, the 625 Mark II is offered with an extended BASIC language operating system and up to 60K bytes of internal RAM.

Dual flexible disk drives store up to 630K bytes of data. These drives can be used for both program and data storage.

The 625 Mark II contains a 1280 character CRT display as well as a 40-column alphanumeric matrix printer. The 625 Mark II is also available in a 19" rackmount version.

Prices start at $8,000. Delivery 60 days. For more information contact Compucorp, 1901 S. Bundy Dr., Los Angeles, CA 90025, (213) 820-2503.

CIRCLE INQUIRY NO. 135

Studio II Conversion Kit

Aresco has announced the availability of information and components to convert the RCA Studio II video game into a simple microcomputer. The information package describes how to construct a new cartridge for the Studio II, includes schematics, ROM monitor listing, operating instructions, and program listings, and is available for $5.

Aresco also offers a printed circuit board and pre-programmed PROM containing the conversion program, as well as a fully assembled and tested cartridge. No modifications to the Studio II are required.

With the new cartridge, the user can enter machine language programs through the Studio II keypads, and the programs can be controlled from the keypads and generate TV displays on a standard TV attached to the Studio II.

The converted Studio II is a simple, powerful microcomputer containing 512 bytes of RAM, 256 bytes of ROM, an RCA COSMAC 1802 microprocessor, a video graphics interface, an FCC-approved RF modulator, two ten-key keypads, and a processor controlled "beeper."

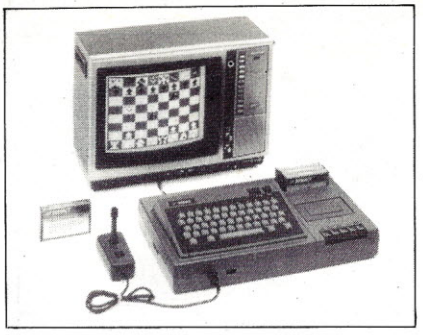
Orders for the information package, which contains pricing for the components as well as for the assembled cartridge, should be sent to Aresco, P.O. Box 43, Audubon, PA 19407. MC/Visa/BAC orders accepted, but no C.O.D. or billing available. For more information contact Rick Simpson by telephone (215) 631-9052 or 631-9257.

CIRCLE INQUIRY NO. 136

Model One More Powerful

Interact Electronics has doubled the maximum memory capacity of its Model One computer from 8K to 16K bytes RAM. The expanded 16K memory permits use of Interact's soon-to-be-released Enhanced Level II BASIC, a powerful, yet easy-to-use programming language based on the industry standard Microsoft™ BASIC.

The suggested retail price for Interact's 16K computer is $599.95. Included with the computer is a library of 13 pre-programmed cassette tapes which provide a wide range of programming, educational and entertainment capabilities.



For more information contact Interact Electronics, P.O. Box 8140, Ann Arbor, MI 48107.

CIRCLE INQUIRY NO. 137

The SHC-8000 Computer

The Teal SHC-8000 computer system is designed to meet the needs of a small business computer. In its "Basic System" version, it is ideal for those who need a personal computer for educational and other purposes. The "Total System" is an upgraded basic version that has additional peripherals capable of providing a solution to the data processing problems found in both large and small business situations.

The Basic System has a Z-80 microprocessor, 16K bytes of ROM, 16, 32, 44K bytes of RAM, I/O bus connector for motherboard, hardware clock timer, cassette tape, TTY 48 key keyboard and 11 function keys, video text display 16 lines of 32 or 64 characters, and more.

The Total System offers a powerful disk operating system when configured with mini-floppy diskettes. Up to four mini-disk units may be attached to the SHC-8000.

For more information contact Teal Industries Inc., Victoria Business Park, 251 E. Victoria Ave., Carson, CA 90746, (213) 532-9631.

CIRCLE INQUIRY NO. 138

Why Be A MAC Dealer?

The MAC Dealer Program offers the unique opportunity for you to cash in on the gigantic new small business computer market. You control your territory — you set your own margins.

The MAC Dealer Program is a total turnkey boxed program — starter systems — step-up systems — multi-user large systems — all pre-packaged, eliminates the need for highly trained sales and service personnel. MAC leads you from sales to final installation via the MAC pre-packaged sales program.

MAC software has been running for years on large computer systems. MAC software is unmatched for base of use, ease of training, completeness of information. MAC uses IDBM™ based software. MAC software is tried and proven software.

MAC provides you over the counter exchange on defective components — you write your own maintenance contracts — you control your service territory — MAC backs you with strategically located parts depots.

MAC provides dealer sales training. MAC provides factory service training.

Get into the high volume computer forms business the MAC standardized forms way.

The MAC Dealer Program is tailored specifically for the office machine dealer market. MAC supplies you the Dealer with everything necessary for you to be successful in the small business computer market. MAC's team of professionals stand behind you in sales, service, training, software and forms. For more information call Management Analysis & Control, Inc., (206) 939-5676.

CIRCLE INQUIRY NO. 139

Atari Enters Personal-Home Computer Industry

Atari Inc., a division of Warner Communications Inc. is entering the personal-home computer industry with two new personal computer systems developed for use by both those people with no prior computer experience and those with experience and sophisticated needs and requirements.

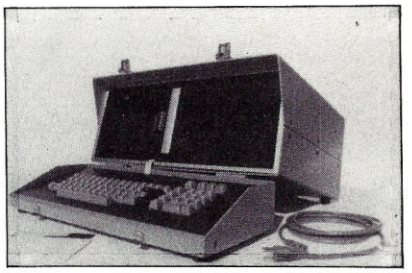
The Atari-400™ and Atari-800™ computers contain electronics design featuring custom integrated circuits for superior color graphics display, superior sound and music synthesis, slots for instantaneous use of preprogrammed solid state cartridges and compatibility with a custom tape recorder for program storage and retrieval. Both systems are programmable by the user in the most popular language for personal computers, BASIC.

For more information contact Warner Communications Inc., Atari Inc. division, 75 Rockefeller Plaza, New York, NY 10019, (212) 484-8936, Jonas Halperin.

CIRCLE INQUIRY NO. 140

Portable S-100 Based System

This portable S-100 computer comes in a single enclosure measuring only 20¼" x 8" x 16", for those who enjoy a clean desktop, free from excessive cables and hardware. Being portable, it satisfies the needs of the person on the go because it may be closed into a suitcase-style cabinet with a retractable carrying handle.



The unit is constructed using 0.125" aluminum alloy throughout. The mainframe combines a 9-inch high resolution CRT display, an 8-slot S-100 4MHz card cage, a 14 amp fully fused power supply, and a 77-key full function keyboard with numeric pad and cursor control keys.

Introductory price is $1,089. For details contact GM Research, Inc., 1048 E. Burgrove St., Carson, CA 93017, (213) 639-4663.

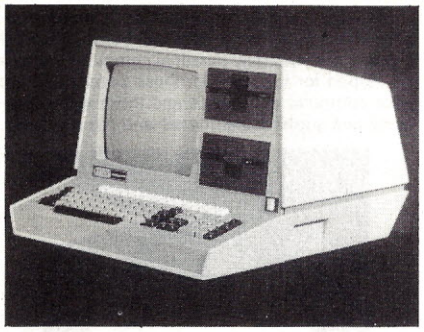
CIRCLE INQUIRY NO. 141

Microsystem

The Billings Microsystem computer features 64K bytes of RAM memory and 320 bytes of storage in its internal double density 5-inch floppy disks. It is based on the Z-80 microprocessor.

The Microsystem utilizes highly advanced technology enabling all the computer circuitry to reside on a single printed circuit board. The video terminal, computer memory boards, keyboard and disk storage are all enclosed inside a single compact cabinet. Completing the system is an electrostatic printer.

The Billings Microsystem, featuring keyboard, CPU, 5-inch disks, video screen and printer is



priced at $3,995. For more details contact Billings Energy Corp., 2000 E. Billings Ave., Provo, UT 84601, (801) 375-0000, Alene Bentley.

CIRCLE INQUIRY NO. 142

Vista Computer Offers Service Bureaus Entry into Turnkey Market

A combined program of training, marketing and hardware support that will enable computer-service bureaus to enter the turnkey-systems market for as little as $3,500 has been announced by Vista Computer, Inc.

Vista will provide training, on-line programming, testing and database loading needed to enable service bureaus to gain turnkey-systems experience without committing to the cost hardware.

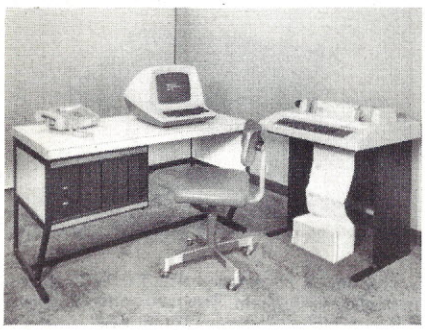
The $3,500 fee includes the use for three months of a CRT terminal and printer linked at a service-bureau location to Vista's central computer system.

The company's headquarters are at 2 Corporate Park Dr., White Plains, NY 10604.

CIRCLE INQUIRY NO. 143

New Micro System

Industrial Micro Systems announces their complete microcomputer based system. The system consists of an attractive, industry unique mainframe enclosure with a cast aluminum front panel and woodeside or rack-mount options. As pictured, a desk enclosure is also available with the system.



Field proven processor, I/O and memory boards combine to achieve a total system of unparalleled quality in the industry. The standard configuration includes 32K bytes of memory, over 500K bytes of floppy disk storage and two serial I/O ports, all of the above are expandable.

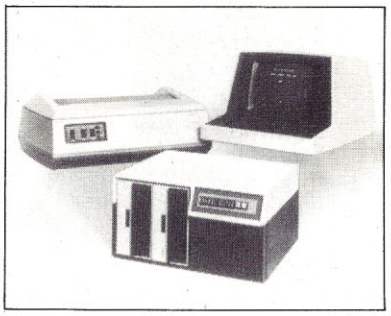
For more information contact Industrial Micro Systems, 628 N. Eckhoff St., Orange, CA 92668, (714) 633-0355, Murray Shackelford.

CIRCLE INQUIRY NO. 144

Small Business Computer System

An expandable computer system with software for automating small business accounting procedures has been introduced by Computer Management Group, Inc.

The Omicron Business Computer is a Z-80 based small business computer featuring system architecture that permits expansion as business volume increases.



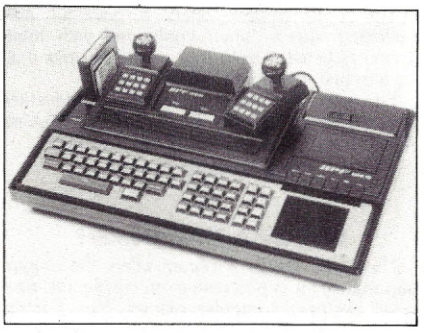
The basic Omicron system consists of 64,000 character Z-80 computer, 2 floppy disks, 160 character/sec printer and an interactive CRT display. Software includes inventory control, order processing, payroll, accounts receivable and payable and general ledger.

The system is priced from $15,000 complete with software. For more information contact Computer Management Group, Inc., Elm St., P.O. Box 698, Merrimac, NH 03054, (603) 424-9947, Norm Sorois, Vice President.

CIRCLE INQUIRY NO. 145

MPA-10 Consumer Computer

APF Electronics introduces an extraordinary new concept in home computer marketing, through its second generation dual module system. The first module (MP 1000) encompasses a wide spectrum of entertainment and educational functions.



The second (MPA-10), an adaptable, highly-sophisticated computer, is designed to perform a myriad of functions and on a combined basis is priced to appeal to the mass retail market.

The MP 1000 and MPA-10 as a combined unit will retail for less than $500. For more information contact APF Electronics Inc., 444 Madison Ave., New York, NY 10022, (212) 758-7550.

CIRCLE INQUIRY NO. 146

Compucolor Corporation Announces Price Cuts

Compucolor Corporation, manufacturer of the color-graphics home computer, the COMPUCOLOR II, has announced major price cuts that affect two of the three available models and many of the options and accessories. The COMPUCOLOR II Model 4, which includes a 13-inch 8-color CRT, a built-in mini-floppy disk drive, extended disk BASIC in ROM and 16K user RAM has been reduced from $1,795 to $1,695.

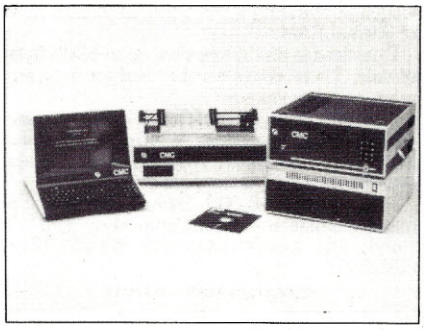
The Model 5, which has 32K of memory, has been reduced from $2,395 to $1,995. The price of the add-on single disk drive has been reduced 20%; 16K RAM module, 50%, and formatted Sof-Disks over 50%.

For more information contact Compucolor Corp., P.O. Box 569, Norcross, GA 30071, (404) 449-5879, Susan Sheridan, Mktg. Rep.

CIRCLE INQUIRY NO. 147

California Microcomputer Company Adds 7800 Small Business System

California Microcomputer Company announces the addition of the 7800 Complete Small Business System to its line of 7700 microcomputers. The single-unit CPU/Disk system features a Z-80 processor, 48K bytes of RAM and two standard double-density floppy disk drives with 1.2 megabytes of on-line storage.



In addition there is a 24x80 video display and keyboard with lower case and numeric pad, and a 150 cps bi-directional printer with expanded and compressed print capabilities.

For details contact California Microcomputer Co., P.O. Box 3199, Chico, CA 95927.

CIRCLE INQUIRY NO. 148

APL Computer System

The APL computer system has a Z-80 CPU, 20K byte active workspace, more than 500K byte dual disk for permanent storage of workspaces, copy objects and APL files, APL keyboard and CRT screen.

The unit also features APL/Z-80 Release 2.0 software which includes all features of APL/Z-80 Release 1.0 plus latent expression, dynamic execution of system commands in defined APL functions and shared variable interface.

Standard Auxiliary processors supplied include a processor for I/O to any Z-80 I/O port. This processor allows efficient device control using simple defined APL functions for any devices interfaced to Z-80 I/O ports.

A second auxiliary processor implements a file system featuring a directly indexable file having variable length records, each of which maybe an APL array of arbitrary type, shape and size (up to available workspace. This file system is comparable to the file systems available on most APL timesharing services and allows such sophisticated file structures as indexed sequential files, etc.

Price is $6,495, delivery 30-60 days after arrival or order. For more information contact Vanguard Systems Corp., 6812 San Pedro, San Antonio, TX 78216, (512) 828-0553.

CIRCLE INQUIRY NO. 149

New Development System

A higher powered, lower priced version of the System 29, the System 29/05, contains all printed circuit-board construction for increased reliability and twice the number of writeable control slots for the simulation of up to 4K x 128 bits of microcode.

A new flexible power supply assignment allows the user to reassign the internal supply to either power additional high-speed WCS cards or the in-board prototype slots.

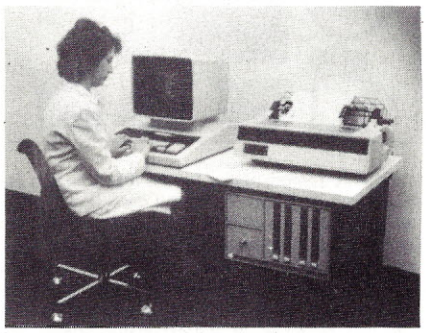
Universal prototyping cards allow designers to prototype within the system's structure, or outside of it, through the use of interfaces and cables. A high-speed random-access memory — organized 1024 words by 64 bits — can be expanded with additional memory modules. It allows real-time simulation of the microcode of the fastest micro-programmed machines.

Price is $18,850 and is available from Advanced Micro Devices' sales personnel, AMD reps or distributors. For more information contact Advanced Micro Computers, 3340 Scott Blvd., Santa Clara, CA 95051, (408) 988-7777.

CIRCLE INQUIRY NO. 150

Escrow Business Administration Systems

AIC has announced the release of a new Escrow Business Administration (EBA) System designed to reduce the administrative costs and problems which exist in many California escrow and real estate offices.



Designed specifically to overcome the limitations and drawbacks of the computerized escrow processing services previously provided by some commercial banks, the EBA provides much faster closing times and with a greatly reduced error rate.

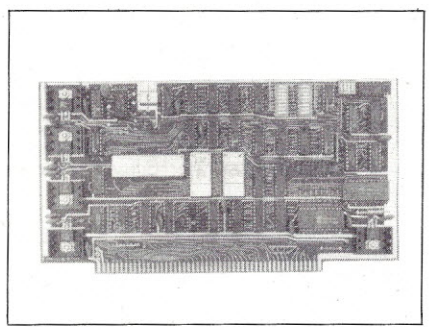
The EBA System consists of a microcomputer mounted in a desk, a television-like video display terminal, a high-speed printer, and a package of computer programs.

For details contact Adventures In Computing, Inc., 8756 Warner Ave., Fountain Valley, CA 92708, (714) 848-8388, Mr. Hancock.

CIRCLE INQUIRY NO. 151

S-100 8080 CPU Board

SSM (formerly Solid State Music) introduces its new CB1 8080 CPU board for S-100 bus computers. The CB1 contains enough RAM, EPROM and other features to allow a 2 board computer. All that is needed is an I/O or video board.



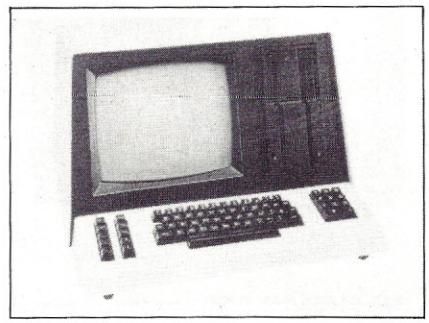
The CB1 has 256 bytes of on-board RAM for scratch memory that can be DIP switch addressed to any 256 byte boundary. Sockets are provided for 2K of 2708 EPROMs for a monitor program, small operating system, industrial control software or other functions.

The CB1 price for kit is $144.95. Available assembled. For more information contact SSM, 2116 Walsh Ave., Santa Clara, CA 95050, (408) 246-2707.

CIRCLE INQUIRY NO. 152

Small Business System

The SDS 420 is a new small business microcomputer system, priced at less than $8,000, but with the processing speed and quality components usually associated with large computer systems.



Designed for professional use, the SDS 420 is a complete system self-contained in a small desktop cabinet. All subsystems are modular for simple servicing. The system includes a 2MHz 6502A microprocessor, 32K bytes of memory, from 1½ to 10 megabytes of floppy disk storage, a 12-inch CRT display and 71-key alphanumeric detachable keyboard.

Price is $7,700 single unit. Delivery is 90 days ARO. For more information contact Scientific Data Sytems, Inc., 12640 Beatrice St., Los Angeles, CA 90066, (213) 390-8673.

CIRCLE INQUIRY NO. 153

Microcomputer System Features TV Input & Digital TV Display

The Beck-1/System combines a general purpose microcomputer system with a programmable display processor capable of digitizing a TV input signal and displaying a digital TV picture.

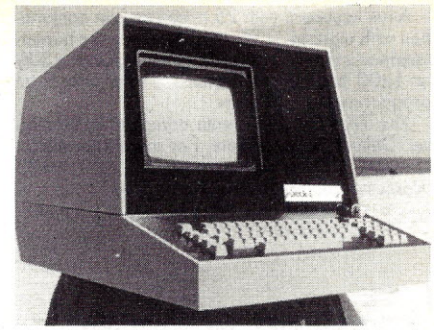
Housed in a terminal type enclosure, the unit includes a Z-80 CPU, up to 64K bytes of CPU RAM and 32K bytes of CPU ROM, serial and parallel I/O ports, floppy disk storage, a keyboard and CRT display.

The Beck-1/System is priced from $2,900. For more information contact the Beck Corp., 303 Slocum Ave., Neptune, NJ 07753, (201) 922-3579.

CIRCLE INQUIRY NO. 154

Arcade Computer System Features Portraits & Biorhythm

The Beck-1/Arcade represents a breakthrough in performance and packaging in the computer photography and arcade market. Combining the computer and TV input processor, operators monitor and keyboard into one compact, portable package, the Beck-1/Arcade offers computer portrait systems users features and convenience not available anywhere else.

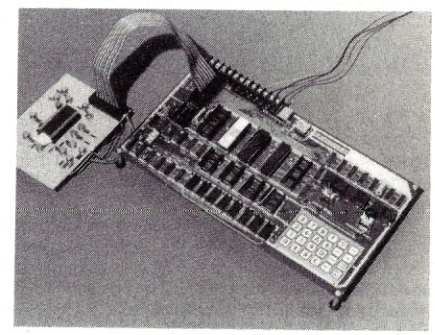


The Beck-1/Arcade is available with or without a printer and video package. The biorhythm option is $1,000 on either package. For more information, contact Beck Corp., 303 Slocum Ave., Ntpeune, NJ 07753, (201) 922-3579.

CIRCLE INQUIRY NO. 155

F3870 Training Course Includes Take-Home Microcomputer Board

A newly developed F3870 single-board microcomputer is being offered to systems designers who attend a four-day F3870 and F8 training course conducted by Fairchild Camera and Instrument Corporation.



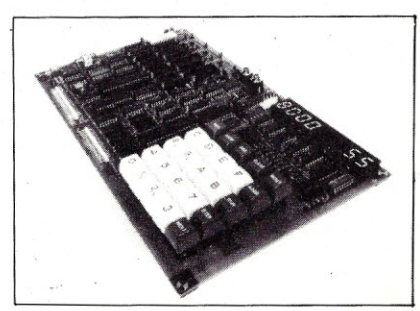
The F3870, designed for prototyping, emulating and programming (387X PEP system), can be used as a design aid for any systems based on standard F3870, F3872, F3874 or F3876 devices.

The F3870 and F8 course, including the microcomputer is $500. For more information contact Fairchild Camera and Instrument Corp., 464 Ellis St., Mail Stop 20-1000, Microprocessor Training, Mountain View, CA 94042, (415) 962-3710.

CIRCLE INQUIRY NO. 156

Single Board Computer Uses 8080A As Processor

A single board computer using the 8080A was announced by NEC Microcomputers, Inc. Designated the TK-80A, the device has a unique combination of hardware and software features and is the perfect system for computer education.



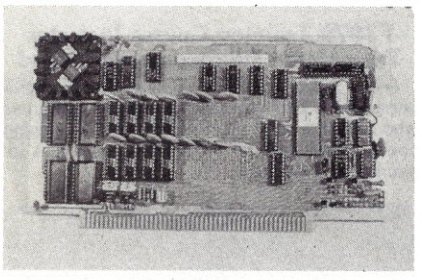
A full keyboard with 25 raised keys in conjunction with eight ½" LED displays make the human interface a delight to use. The unit includes a 300 or 1200 baud cassette interface and three 8-bit programmable I/O ports.

The TK-80A comes with complete instruction set. Delivery is immediate. For more information contact NEC Microcomputers, Inc., 173 Worcester St., Wellesley, MA 02181.

CIRCLE INQUIRY NO. 157

6502 MPU for S-100 Bus

A 6502 MPU Board for the S-100 bus is available from CGRS Microtech. The standard size p.c. board contains the 6502 microprocessor, 2K bytes of RAM, 4K bytes of 2708 EPROM, TTL support logic, and voltage regulators.



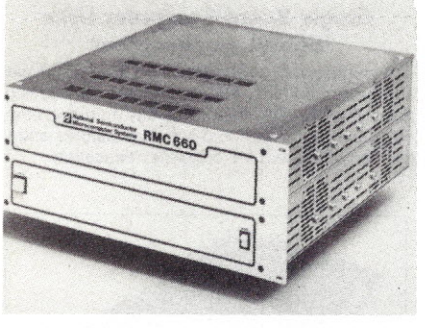
Users of the 6502 can still enjoy the high speed and addressing modes of the device while taking advantage of the extensive variety of S-100 product offerings.

The 6502 MPU board is available in kit form without memory for $149.95, assembled and tested without memory $179.95, or assembled and tested with memory $279.95. For additional information contact CGRS Microtech, P.O. Box 368, Southampton, PA 18966.

CIRCLE INQUIRY NO. 455

System Package Aids Series/80 System Assembly

A new completely-assembled, rack-mounted system accepts up to eight Series/80 microcomputer, memory and interface boards. Designated the RMC 660, the units consist of two system board chassis, power supply and front panel with control switches mounted in a standard RETMA enclosure.



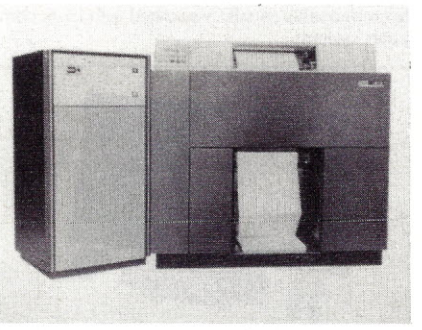
The RMC 660, including power supply and dual fans is 7" high, 19" wide and 20" deep. The price is $1,250 each. Delivery is 30 days to stock. For more information contact National Semiconductor Corp., Computer Products Group, 2900 Semiconductor Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 457

PERIPHERALS

New Spur Controller Links HP 3000 to IBM 1403 Printer

A controller that enables the Hewlett-Packard HP 3000 computer to operate IBM 1403 printers is now available from Spur Products Corporation.



The S1403/HP 3000 controller contains all the interface, control and power functions necessary to make the computer plug-compatible with model 1403-2, -3 and -N1 printers.

The controller is offered in a stand-alone enclosure and includes all logic cards, memories, mating connectors and power supplies necessary for operating the printer. Price is $17,500. Delivery is 60 days. For more information contact Spur Products Corp., 1904 Centinela Ave., Los Angeles, CA 90025.

CIRCLE INQUIRY NO. 158

The CGB (Color Graphics Board)

Biotech Electronics has introduced a new, low cost, high density color graphics board (CGB). The CGB can operate in any S-100 microcomputer. It is capable of generating 8 colors or 2 sets of 4 colors. It has 11 different software selectable modes: 1 alphanumeric mode — 32x16 characters in a 2-color display, 2 semi-graphic modes with display densities ranging from 64x32 to 64x48 in 8 and 4-color sets, and 8 full graphic modes with display densities ranging from 64x64 to 256x192 in 2 and 4 colors.

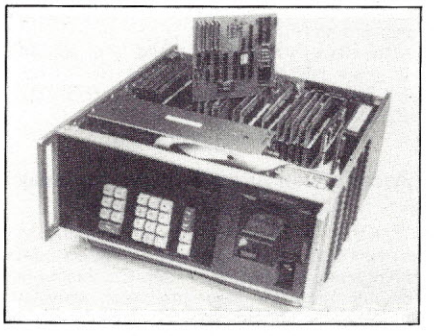
Special features included are 6K bytes of onboard screen refresh RAM, bank select, board protect, composite video and a light pen input port.

The CGB is priced at $295 in kit form, and $345 assembled and tested. Software graphics driver routines for the 8080 and Z-80 are supplied. For more information contact Biotech Electronics, P.O. Box 485, Ben Lomond, CA 95005.

CIRCLE INQUIRY NO. 159

Interface Links MCSIM to Any Host Computer

A paper tape emulating interface for linking a microprocessor development station to any host computer has been introduced by Analytyx Electronic Systems, Inc.



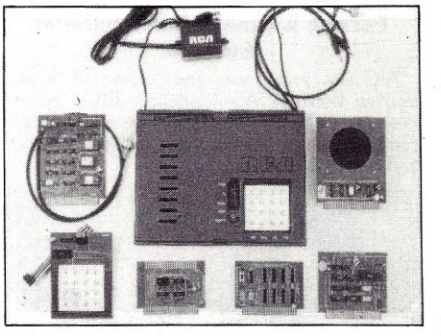
The Analytyx A10000 MCSIM Link is an RS-232C interface that allows direct connection between any host computer and a Scientific Micro Systems (SMS) MCSIM microprocessor development station for the Signetics 8X300.

The Analytyx A10000 is priced at $970 in single units. THe A10010 Software sells for $500 per facility. For more information contact Analytyx Electronic Systems, Inc., 106 Daniel Webster Hwy. So., Nashua, NH 03060, (603) 888-5400, Robert Jehu, Vice President.

CIRCLE INQUIRY NO. 160

RCA Offering Add-Ons for VIP Personal Computer

RCA is offering a variety of supplemental options for its VIP personal computer that will increase the system's flexibility, enhance its utility and increase the user's enjoyment.



RCA is demonstrating for the first time two expansion boards, one to permit the VIP to generate music and the other to permit video displays in eight colors. Additionally, RCA is now offering an expanded memory. The standard VIP contains 2K of memory, with provisions for an additional 2K on the existing memory board; another 4K can now be added on the expansion board.

For more information on these and other options available for the VIP contact RCA COSMAC VIP Marketing, New Holland Ave., Lancaster, PA 17604, (717) 291-5848, Rick Simpson.

CIRCLE INQUIRY NO. 161

TRS-80 Output Relay Board

The TRS-80 owner can now use his computer to control up to 16 external devices with the CP-16 board, which plugs directly into the rear of the Level II keyboard (or into the expansion interface if one is used).

Any of up to 16 relays per board can be closed or opened with the OUT command followed by the chosen relay's numerical address and ,0 to close or ,2 to open.

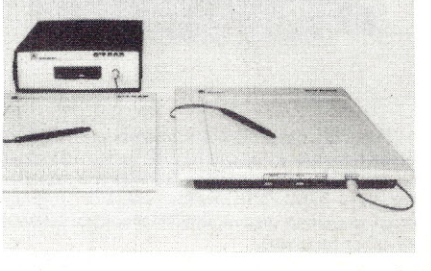
The CP-16 board with power supply but without relays is $99. Cable to TRS-80 is $10. Each relay is $5.85. Purchasers may order by mail using their Visa or Master Charge number.

For more information contact Hoch Co., P.O. Box 856, Corona del Mar, CA 92625.

CIRCLE INQUIRY NO. 162

Bit Pad One

Summagraphics Corporation has added to its highly successful low-cost digitizer, the Bit Pad, with a new one-piece version, the Bit Pad One. Bit Pad One is a wholly integrated digitizer combining both the tablet and electronics in one tabletop unit.



The Bit Pad One is, just as was the original Bit Pad, geared to serving the needs of the rapidly expanding personal and home computing markets. The new Bit Pad One with interface is available immediately at a price of $666. For more information contact Summagraphics Corp., 35 Brentwood Ave., Fairfield, CT 06430, (203) 384-1344.

CIRCLE INQUIRY NO. 163

Arithmetic Board

A board-level, arithmetic-processing unit designed to enhance the computational capability of 8-bit microprocessor-based systems is now available from Advanced Micro Computers.

The AMC 95/6011 performs addition, subtraction, multiplication, and division in either single precision (16-bit) fixed point, double precision (32-bit) fixed point or floating-point (32-bit) trigonometric, inverse trigonometric and log functions in a 32-bit floating-point format.

This arithmetic board is both mechanically and electrically compatible with the Intel SBC 80 board-level product series as well as with the Intel MDS 80 development system.

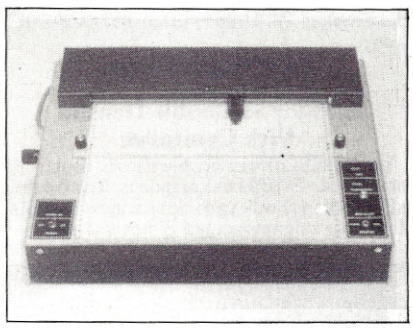
The Am95/6011 features a 16-bit on-board counter that provides a mechanism for monitoring the operation speed of the Am9511 APU as well as measuring other event durations.

Price is $595. Delivery is 30 days ARO. For more information write Advanced Micro Computers, 3340 Scott Blvd., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 164

Strip Chart Recorder

Model 47-TR series of strip chart recorders takes digital data directly from computer RS232 or instrument bus. It converts digital input into a smooth analog curve at a writing rate of 75cm per second.



Paper advance and pen lift are under digital control. No additional interface is required. The paper is advanced 300 requests per inch and will operate at 2400 baud. Useful for obtaining plots from data acquisition systems.

Price is $785. For more information contact Pedersen Instruments, 2772 Camino Diablo, Walnut Creek, CA 94596, (415) 937-3630.

CIRCLE INQUIRY NO. 165

TRS-80 Speech Synthesizer

The Model CT-1T Speech Synthesizer is a completely self-contained unit. It is packaged in a 6" high by 4" wide by 12" long chassis and has its own 110 VAC power supply.

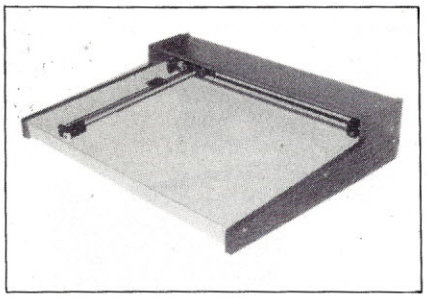
The interface circuit board contains an on-board 2 watt audio amplifier, an S-100 connector for the CT-1 speech synthesizer board, and a Radio Shack compatible edge connector.

Suggested retail price for the Computalker Model CT-1T is $595 and includes the self-contained unit, interconnect cable, user manual and software. A special unit is available for persons who already own a Model CT-1 and is priced at $225. Computalker Consultants is making a limited introductory offer of the Model CT-1T for $495. For more information contact Computalker Consultants, 1730 21st St., Suite A, Santa Monica, CA 90404, (213) 392-5230.

CIRCLE INQUIRY NO. 166

X-Y Plotter Unit

This unit includes a plotter, drawing surface, electronics and power supply completely assembled and ready for interface to any 8-bit TTL Parallel port. Pen holder accepts any writing instrument or sylus 7-11 mm diameter.



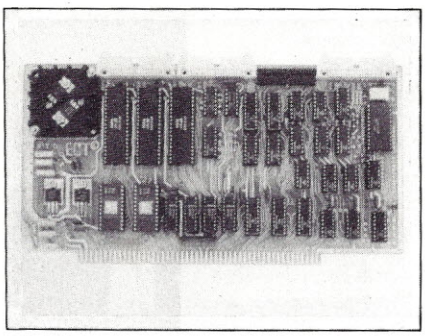
The unit is encoded for 0.01-in/pulse, but 0.005-in optional. Pen travel speed is 2.5-in/sec max. with 24 volt supply. A basic 8080 software program is included in the owner's manual.

Brochures are available free on request. Owner's manual can be purchased separately. For more information contact Sylvanhills Laboratory, Inc., P.O. Box 646, Pittsburg, KS 66762, (316) 231-4440.

CIRCLE INQUIRY NO. 167

ROM, RAM and I/O Board

R²I/O is an S-100 Bus I/O Board with 3 serial I/O ports, 1 parallel I/O port, 4 status ports, 2K of ROM and 2K of RAM. The R²I/O provides a convenient means of interfacing several I/O devices, such as CRT terminals, line printers, modems or other devices, to an S-100 bus microcomputer or dedicated controller.



It also provides for convenient microcomputer system control from a terminal keyboard with a ROM monitor containing executive commands and I/O routines. Low profile sockets are provided for all integrated circuits.

Price is $295. For more information contact Electronic Control Technology, 763 Ramsey Ave., Hillside, NJ 07205, (201) 686-8080.

CIRCLE INQUIRY NO. 168

Frugal Front Panel Boards

Presently, this series includes three boards: the S-100 Display-Sense Board, a maintenance and programming aid which adds bus viability to "front panel-less" S-100 microcomputers, easily and at low cost. It provides on-board visual readout of Address, Data and six Status lines, as well as a Sense switch input capability. Kit is $89.95, bare board $27.50

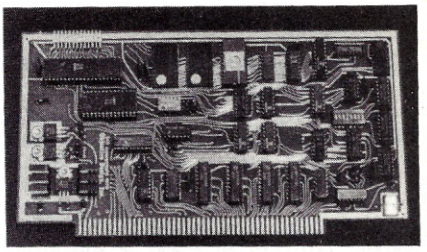
The Remote Binary Panel can be used with the Display-Sense or user's own driver. The kit comes with cables, 30 front panel LEDs and eight switches. Kit is $64.95, bare board $21.95; the Remote HEX Panel features six 7-segment HEX displays for Data and Address, six Status LEDs, cables and eight Sense switches. Kit is $69.95, board $21.95.

For more information contact Digital Dynamics Inc., P.O. Box 27243, San Antonio, TX 78227.

CIRCLE INQUIRY NO. 169

Computer Juggles Many Tasks

S-100 computers can handle simultaneous problems when outfitted with the Multitasker, an interrupt handling board from Objective Design, Inc. Having interrupts in the system allows one computer to do the work of many.



With an interrupt driven system you can handle program development on several terminals at once, run household appliances and play games at the same time, and continue using the computer while a slow printer is churning out a listing.

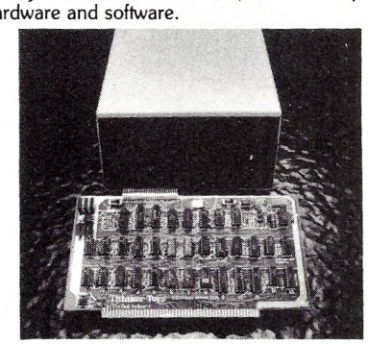
Multitasker without PROM in kit form is $205.95. For more information contact Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304, (904) 224-5545.

CIRCLE INQUIRY NO. 170

DISKS

DISCUS I™

The DISCUS I is a full-size floppy disk memory for S-100/8080 microprocessor systems. The DISCUS I is sold as a complete system, completely assembled and tested, with all required hardware and software.



Hardware includes a Shugart 800R full-size disk drive and independent power supply; software includes BASIC-V™, a virtual disk BASIC with the ability to address up to two megabytes.

Price is $995 (plus tax and handling). For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-5317, Neila Richmond.

CIRCLE INQUIRY NO. 171

Imsai Announces Hard Disk

The HD-10 Hard Disk System features the CDC Hawk Model 9427H hard disk. The HD-10 provides 10 megabytes of formatted on-line storage per unit.

The 9427H is a high-performance, random access storage device which uses a single fixed disk for 5 megabytes of storage.

Included with the HD-10 system is the new IMDOS II operating system. Any applications written under IMDOS will run under IMDOS II with little or no modification.

For more information contact Imsai Manufacturing Corp., 14860 Wicks Blvd., San Leandro, CA 94577.

CIRCLE INQUIRY NO. 172

Storage Technology Corporation Offers Double Density Disk

The STC 8650 double density disk drive offers 635 MD of data storage per spindle by doubling the track density from the standard STC 8350.

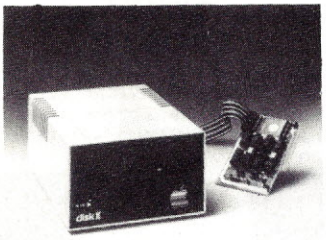
The STC 8650 is housed in the same physical dimensions as the earlier STC 8350. Users can satisfy immediate needs now with the STC 8350, and later these units can be field upgraded to double their capacity.

For more information contact Storage Technology Corp., 2270 So. 88th St., Louisville, CO 80027, Tom Purtell.

CIRCLE INQUIRY NO. 173

Apple Disk II

The Disk II is an intelligent peripheral for the Apple II personal computer and offers rapid access to programs and data, making home applications faster and more useful. Personal finance, too, becomes easier with the disk.



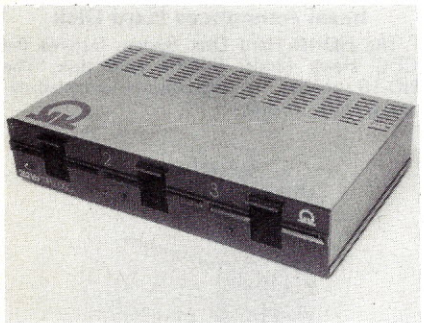
A user can store a year's worth of financial records in one place and sort them quickly. Disk II also allows the Apple II to handle a wide range of business applications.

For more information contact Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014.

CIRCLE INQUIRY NO. 174

Megabyte Disk System

The double-density 262kb is a triple floppy, powered by three dependable, and independently powered DC, Shugart minifloppy drives for maximum performance and protection. To reduce time consuming diskette handling, the triple drive engineering provides a generous unformatted capacity of 656.4k bytes.



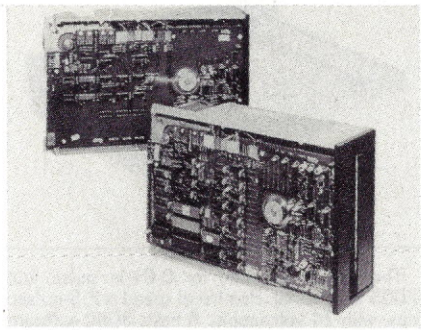
Plus the fact that the rear mounted 34 conductor cable connector means the 262 kb is a snap to interface to any controller board. We put the double density 262 kb through a rigorous quality control program.

For more information contact Computerware, 1326 S.W. 12th Ave., Portland, OR 97201.

CIRCLE INQUIRY NO. 175

Intelligent Flexible Disk Drives

A complete line of intelligent flexible disk drives with built-in controller/formatters is available from the Remex Division of Ex-Cell-O Corporation. The series of subsystems, available in single or double density and single or multi-drive configurations, can reduce hardware costs, design time and interface cost for the systems designer.



Unique to the subsystems is the Remex 6800 microprocessor-based controller/formatter, which is mounted on a single printed circuit board within the drive enclosure.

Prices for the Remex subsystem begin at $938 for small OEM quantities of the Remex 1210 drive. Delivery is 30 to 60 days. For more information contact Remex, P.O. Box C-19533, Irvine, CA 92713.

CIRCLE INQUIRY NO. 176

PEDISK Floppy Disk for PET

The PEDISK System is a combination floppy disk and S-100 expansion chassis for the PET. The Pedisk features the EXS100 disk control card and a minifloppy disk drive. Two additinal minifloppy drives can be added for a total of 240 Kbytes storage.

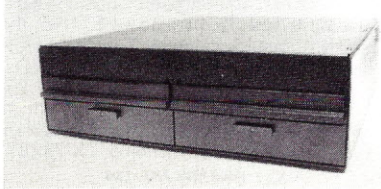
Standard IBM 3740 format is used to promote compatibility with other disk systems. The Pedisk has an optional S-100 expansion chassis built in.

The Pedisk System is available in three versions: Disk only $799.95; Disk with 3-slot S-100 chassis $895; and Disk with 10-slot S-100 chassis $1,195. For more information contact CGRS Microtech, P.O. Box 368, Southampton, PA 18966, (215) 757-0284, Joe Swope.

CIRCLE INQUIRY NO. 177

Family of 8-Inch Floppy Disk Systems For M6800-Based Computers

This new family from Smoke Signal Broadcasting includes the Model LFD-1, single drive, single side, single density system; the Model LFD-1, dual drive, single side single density system, both using the Shugart SA-800 drive.



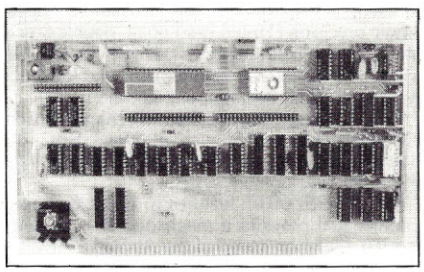
Rounding out the family is the Model DFD-2, a dual drive, double sided, single density system based on the Shugart SA-850 drive.

Prices are $1395 for LFD-1, $1895 for LFD-2 and $2495 for DFD-1. Delivery is 30 days. For more information contact Smoke Signal Broadcasting, 6304 Yucca St., Hollywood, CA 90028, (213) 462-5652, Ed Martin.

CIRCLE INQUIRY NO. 178

EXS100

The EXS100 provides a combination floppy disk controller and S-100 adapter for the PET computer. The EXS100 is a single S-100 P.C. board that connects to the PET memory expansion connector.



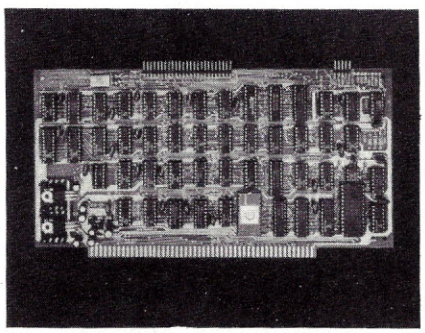
The EXS100 will control up to three minifloppy disk drives in a stand alone configuration. It can then be plugged into any S-100 mainframe allowing the PET owner to expand to the extensive variety of S-100 peripherals.

EXS100 assembled as S-100 adapter only is $199.95; assembled as disk controller only is $299.95; assembled as a combination S-100 adaptor and disk controller is $349.95. Board in a complete package $799.95. For more information contact CGRS Microtech, P.O. Box 368, Southampton, PA 18966, (215) 757-0284, Joe Swope.

CIRCLE INQUIRY NO. 179

S-100 Bus Double-Density Disk Controller

The DOUBLER is a double density floppy disk controller for S-100 bus computers. The Doubler increases floppy disk system capacity to over 500 Kbytes per side of standard 8-inch diskettes.



An on-board 2708 EPROM contains the system bootstrap. The board also includes a hardware UART with RS-232 interface for communication with a console device. Available from stock through computer dealers nationwide. Price is $495. For more information contact Micromation Inc., 524 Union St., San Francisco, CA 94133, (415) 398-0289.

CIRCLE INQUIRY NO. 180

Hard Sector Data Handler

The FDC 3400 Floppy Disk Hard Sector Data Handler (HSDH), an MOS IC designed to simplify the data interface between a floppy disk and microprocessor is available from SMC.

The FDC3400 performs all the data handling required for hard-sectored floppy disk operation, and is for use in low cost floppy disk controller systems.

The HSDH is double buffered, and is usable with single or double density minifloppy or standard floppy disks.

Price of the FDC 3400 is $8.90 for 100 pieces. For more information contact Standard Microsystems Corp., 35 Marcus Blvd., Hauppauge, NY 11787, (516) 273-3100.

CIRCLE INQUIRY NO. 181

Floppy Controller Uses Motorola Chip

Wintek has incorporated the Motorola MCM 6843 floppy disk controller IC into a low cost but extremely versatile and powerful floppy disk controller. The 4½" x 6½" module interfaces to any full size or mini floppy disk drive.

The module supports both hard and soft sectoring, IBM 3740 or user programmable read/write format, automatic CRC generation/checking, and programmable step and settling times.

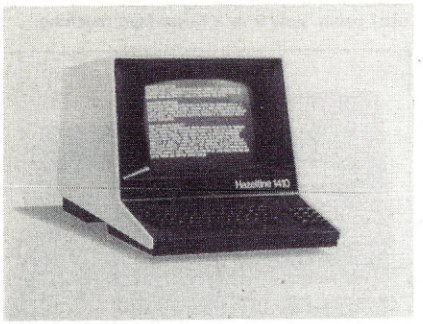
Price is $199 for one. For more information contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904; (317) 742-6802.

CIRCLE INQUIRY NO. 459

TERMINALS

1410 Adds Top-Line Features to Economy Video Terminal

The Hazeltine 1410 is a new low-priced video terminal with all the basic advanced features needed for fast, efficient data entry and data inquiry.



The new 1410 economy computer terminal is based on Hazeltine's earlier models the 1400 and 1500 series, which will continue to be featured. It is designed and backed by Hazeltine with high quality and performance through in-house manufacture of all sub-assemblies, including monitor, power supply and controller.

Price is $580 for annual quantities of 1000 or more, including a 2-year return-to-factory warranty. For more information contact Hazeltine Corp., c/o Irving L. Straus Associates, Inc., 655 Third Ave., New York, NY 10017.

CIRCLE INQUIRY NO. 182

C-PHONE

The C-PHONE is a self-contained telecommunication device for the hearing impaired, with a built-in acoustic coupler and telephone ring signaler.

This unit featurs a 12" CRT with an 80x24 screen format. Messages of 23 lines can be prepared and edited before a telephone call is made, and the same message can be sent again and again.

The C-PHONE is compatible with all telecommunication devices for the deal (TDDs), yet it is the first device of its kind to utilize the versatility of the CRT screen.

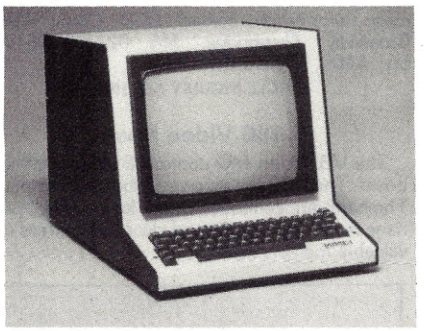
Beyond its obvious application for communication between deaf persons, it is ideal for use by any public organization that wishes to be available to the deaf community.

Price is $550. For more information contact Micro-Term, Inc., 1314 Hanley Industrial Ct., St. Louis, MO 63144, (314) 968-8151, Michael Marks.

CIRCLE INQUIRY NO. 183

MIME and ACT-V

The Micro-Term MIME offers switch-selectable software compatibility with four leading terminals: Micro-Term ACT-IVB, Lear Siegler ADM-3A, DEC-VT52 and Hazeltine 1500. A dealer can now inventory four terminals in a single MIME unit.



In addition, the MIME has an Enhanced Mode which adds the entire repertoire of MIME features to those existing in any one of the four terminal modes.

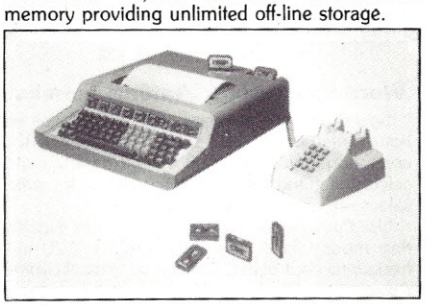
The Micro-Term ACT-V provides, in addition to the entire range of MIME features, separate numeric keypad and software selectable screen formats of 80x24 or 48x39.

Price of the MIME is $795, and the ACT-V is $865. For more information contact Micro-Term, Inc., 1314 Hanley Industrial Ct., St. Louis, MO 63144, (314) 968-8151, Michael Marks.

CIRCLE INQUIRY NO. 184

Portable ASR Terminal Permits Extensive Off-Line Editing

The CDI Miniterm Model 1205 is a portable ASR terminal that features an expandable 8K RAM, permitting extensive off-line editing, and a removable 68,000 character mini-cassette memory providing unlimited off-line storage.



Minimizing connect time and related time sharing costs, the terminal has been enhanced by addition of a new microprocessor-controlled, 50 cps printer.

The CDI Miniterm Model 1205 is priced at $3785. For more information contact Computer Devices, Inc., 25 North Ave., Burlington, MA 01803, (617) 273-1550, Kermit L. Stofer.

CIRCLE INQUIRY NO. 185

Model 680 Portable Terminal

The Model 680 consists of a 132 columns wide 30cps terminal, acoustic coupler, cables and reinforced lightweight carrying case.

The Model 680 Portable Terminal is 132 columns wide, transmits and receives information at 10 and 30 cps, uses regular paper and has both upper and lower case ASCII.

The Acoustic Coupler is a 300 baud unit with EIA-RS-232D interface. It is Terminal Data's Model 312 Acoustic Coupler.

Price is $1,595. Available from stock to 3 weeks. For more information contact Terminal Data Corp., 11878 Coakley Cir., Rockville, MD 20852, (301) 881-7655.

CIRCLE INQUIRY NO. 186

The TLC™

The TLC intelligent terminal communicates in industry-standard RS232 format, transmitting data both by single character and by data blocks in the Block Transmission Mode.

The terminal controls with the use of 16 Special Function Keys, each activating a separate and distinct command. The TLC also displays in blocks of either 12 double-spaced or 24 single-spaced lines in lengths of 80 characters, and is capable of storing two complete pages of data (a total of 48 lines of 80 characters).

For more information contact Problem Solver Systems, 20834 Lassen St., Chatsworth, CA 91311, (213) 998-5100.

CIRCLE INQUIRY NO. 187

CRT Terminal from AJ

The AJ 510 is a versatile CRT with a wide range of standard features including a 15" CRT monitor displaying 24 lines of 80 columns each. Characters are formed by a 7x10 dot matrix in a 9x12 character cell.

The AJ 510 is designed for operator convenience, ease of operation and high data throughput. It comes equipped with a typewriter-style keyboard with an alphanumeric section, cursor control pad, numeric pad and terminal control keys. Two character sets are standard: the full 128 ASCII set and a 40 character graphics set.

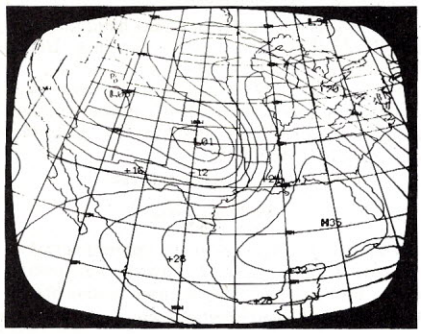
For more information contact Anderson Jacobson, Inc., 521 Charcot Ave., San Jose, CA 95131, (408) 263-8520.

CIRCLE INQUIRY NO. 188

Genisco Computer Graphics System

An ultra-high resolution 1280 pixels per line by 1024 lines (1,310,720 points) raster computer graphics display system allows the utilization of

the full CRT screen. The new gray scale system is a step up from the 1024 pixels per line by 1024 lines version previously available from Genisco.



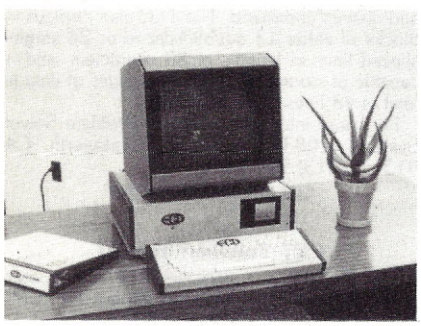
The system is easily expandable, and its modular architecture makes for economical, fast and convenient upgrading as changing requirements dictate.

For prices and more information contact John Fletcher, Genisco Computers, 17805 Sky Park Cir. Dr., Irvine, CA 92714, (714) 556-4916.

CIRCLE INQUIRY NO. 189

Integral Minicassette Loader

The Smart ASCII-1 Programmable Intelligent Terminal automatically loads its program from a built-in minicassette drive when it is turned on. This provides the convenience of a ROM based system, while allowing easy changing or updating of the system.



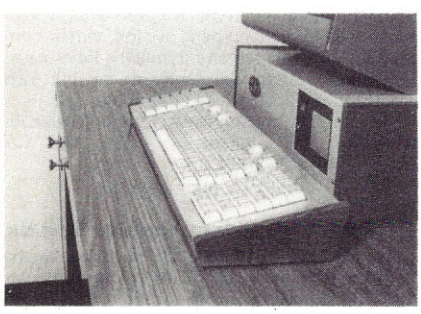
In addition to the terminal program, a version of BASIC is also provided to run in the Smart ASCII-2. It can be run stand alone, or in communication with other computers.

Price is $7700 singles and includes a 15" CRT, an 80-key relegendable keyboard, processor unit with 37K of memory and minicassette drive with tapes for intelligent terminal and Basic programs. For more information contact ECD Corp., 196 Broadway, Cambridge, MA 02139, (617) 661-4400, Richard Eckhardt.

CIRCLE INQUIRY NO. 190

Extended Keyboard for Computer or CRT Terminal

ECD's Extended Keyboard includes 2 extra keypads with 24 keys each, all of which can be programmed by the user for special characters or control functions.



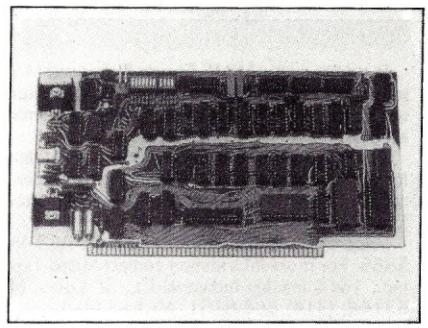
The ECD systems also have a programmable character set which allows the user to define his own characters to match those of special print wheels, including special technical symbols and even foreign languages.

The Extended Keyboard is a $300 option for either the ECD 7X Computer or the Smart ASCII Intelligent Terminal. Delivery is 30-60 days. For more information contact ECD Corp., 196 Broadway, Cambridge, MA 02139, (617) 661-4400, Richard Eckhardt.

CIRCLE INQUIRY NO. 191

S-100 Video Board

The VB2 is an I/O controlled video interface board. The VB2 has its own keyboard input port. The hardware controlled cursor for line feed, carriage return, backspace and clear-screen frees up valuable memory space.



The display is 64x16, all upper case letters as well as numbers and symbols, and is switch selectable for white-on-black or black-on-white. Character width, horizontal margin and vertical position are adjustable.

Available in kit or assembled form. Kit is $149.95. For more information contact SSM, 2116 Walsh Ave., Santa Clara, CA 95050, (408) 246-2707.

CIRCLE INQUIRY NO. 192

Word Processing/Plotting Terminal

Speed: 30 cps standard, 45 and 55 cps optional. Interface: RS232 serial interface. ASCII or corresponding codes. Full or half duplex switch selectable. Odd, even, all or none parity switch selectable. 256 character buffer.

Graphics: Super Carriage Control has two plotting modes (basic and advanced), 1/120 inch horizontal control and 1/48 inch vertical control. Advanced Plotting Mode allows special characters to direct carriage movement. Tabbing up to 158 horizontal tab positions set from keyboard or computer. Spacing: subscripting and superscripting, half line shift up ro down.

Keyboard: 86 keys with 15-key numeric pad. Auto repeat and N-key rollover. Upper case alpha switch selectable (simulates teletype).

Printing: Daisywheel impact printing using Qume Q30 series mechanism, 10 or 12 pitch switch selectable.

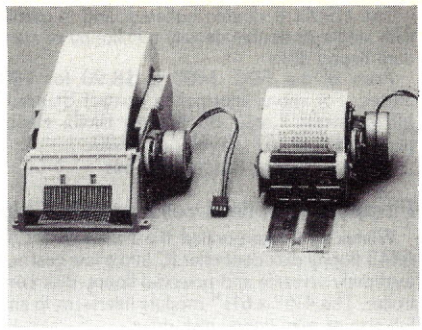
Operator's manual and service manual included. 30 day limited warranty. Price originally $4,500+, now $2150 fully reconditioned, plus tax and shipping where applicable. For more information contact Computer Textile, 10960 Wilshire Blvd., Suite 1504, Los Angeles, CA 90024, (213) 477-2196.

CIRCLE INQUIRY NO. 193

PRINTERS

Thermal Line Printer

Two new thermal line printer assemblies, designated the EPN9112 and EPN9120 offer 12 and 20 character full-alphanumeric capabilities respectively.



Both assemblies print with a 5x7 dot matrix. The low peak-power requirements of both printers make them suitable for battery powered applications.

These assemblies offer the OEM a low-cost, compact printer-assembly which is quiet and reliable. The EPN9112 is $33.62 and the EPN9120 is $46.75 in quantities of 100. Delivery is 4 weeks ARO. For more information contact Texas Instruments Inc., IAS, P.O. Box 225012, M/S 308 (attn: EPN9112/EPN9120), Dallas, TX 75265.

CIRCLE INQUIRY NO. 194

Hardcopy Computer Terminal

Abacus Computer Systems has a low-cost portable computer terminal that is suitable for microcomputers, computer evaluation kits, data entry systems and time sharing systems. The printer uses paper similar to a ticker tape machine.

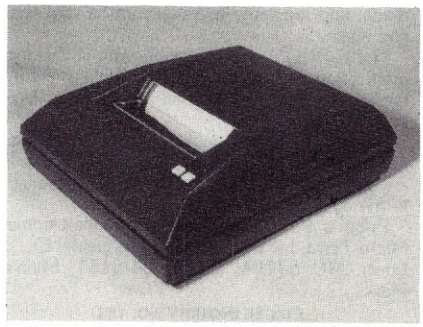
The Model 800 is $295 with the acoustical coupler and $225 without the coupler. Cost of a ½-inch by 450 foot roll of paper is 25 cents. Special offer of 200 rolls of paper for $20 when purchased with a model 800 terminal.

For more information contact Abacus Computer Systems, 6315 Eunice Ave., Los Angeles, CA 90042, (213) 666-1711.

CIRCLE INQUIRY NO. 195

Printerm Model 879 Micro/Mini Printer

High speed bi-directional printing, 120 cps at 75 lines per minute. 9x7 or 9x9 high density matrix, with up to 4 copies. 96 character ASCII character set (upper, lower and triple wide expanded). Operator switch selectable 80 or 132 column format. RS232 and parallel interface.



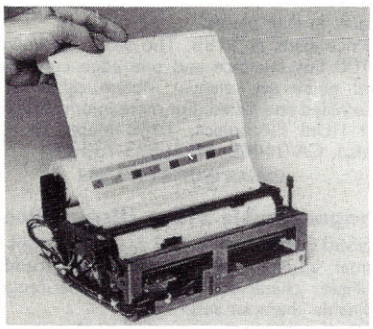
Roll paper feed, combination pin form and roll feed, or tractor feed. 2K memory for full page CRT dump. Simplicity of design with only 3 sub system moving parts for high reliability. All servo motor direct driven.

Price is $1395 for standard model. For more information contact Printer Terminals Corp., P.O. Box 535, Ramona, CA 92065.

CIRCLE INQUIRY NO. 196

Low-Cost Thermal Printer Mechanism

A dot matrix thermal printer mechanism let original equipment manufacturers quickly incorporate hard-copy capability into their terminals and systems.



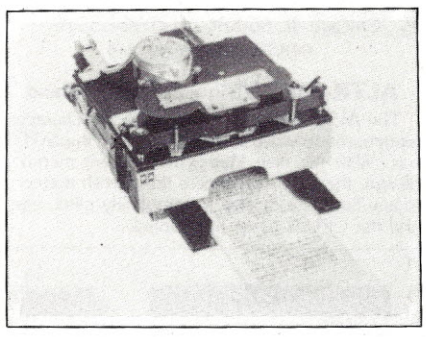
Designated the T-80M, the unit includes the print head assembly, servomechanisms, and servoelectronics. External TTL control signals and power supply only needed.

Price is $890 for single unit, $595 in 100s. Delivery is 30 days ARO. For more information contact Dataproducts Corp., 6219 DeSoto Ave., Woodland Hills, CA 91364, (213) 887-8451.

CIRCLE INQUIRY NO. 197

Ticket Printer

The DMTP-9 ticket printer offers users the ability to print text and graphics on IBM size tickets, forms or cards. The unit uses a dot matrix impact print head and prints up to 48 alphanumeric characters per line and 39 text-spaced or 59 graphic-spaced lines.



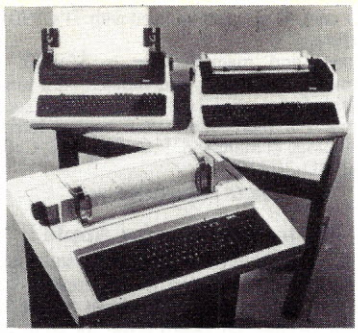
A precise stepper motor controls line spacing density. The printer also offers multicopy capability, logic level control inputs, adjustable card guides and an optional ribbon mechanism.

Price is $310. Delivery is 8 weeks ARO. OEM discounts available. For more information contact Practical Automation, Inc., Trap Falls Rd., Shelton, CT 06484, (203) 929-5381, Fred Simonds, Asst. Sales Mgr.

CIRCLE INQUIRY NO. 198

DECwriter III and DECwriter IV Terminal Printers

The DECwriter III prints at 180 characters per second, and the DECwriter IV Series are table-top terminals. The DECwriter III offers a choice of 8 font sizes, from 5 characters per inch to 16.5.



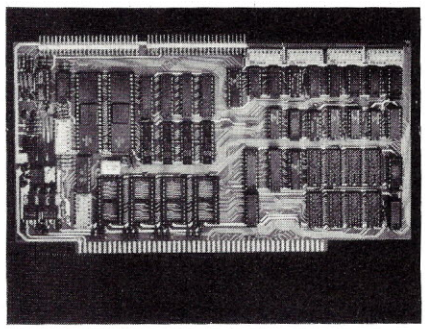
Price for the entry-level DECwriter IV is $1,450, and the DECwriter III is $2,600. For more information contact Digital Equipment Corp., Maynard, MA 01754.

CIRCLE INQUIRY NO. 458

I/O BOARDS

SWITCHBOARD™

An I/O board for S-100 systems, SWITCHBOARD has four parallel ports and two RS232/TTY serial ports plus strobe and attention ports.



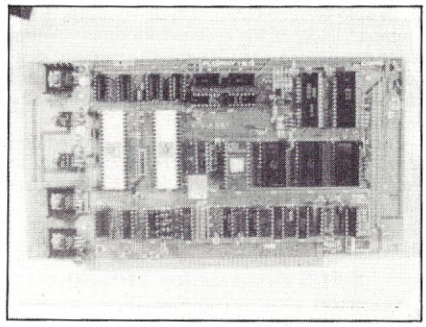
Every port is switch programmable for flexibility in interfacing various types of peripherals. Each parallel port can be switched for input or latched output. Both serial ports can be switch to any of 16 baud rates from 110 to 19K. Each strobe and attention port flip-flop can be switched for positive or negative pulsing.

Price is $199 kit and $259 assembled. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-2101, Hilda Sendyk.

CIRCLE INQUIRY NO. 199

I/O by Trace Electronics

A single I/O card for the S-100 bus contains four programmable parallel ports, two duplex serial ports, baud rate generator, two 16-bit programmable interval timers, room for up to 16K of EPROM, and a connector to adapt the PerSci 1070 intelligent floppy disk controller to the S-100 bus.



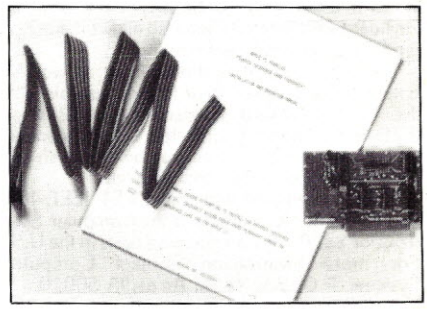
This single card can interface CRT terminals, keyboards, printers, paper tape readers, EPROM programmers, up to four floppy disk drives and still provide EPROM space and two 16-bit timers.

The "Floppy I/O" card is available in kit form for $169.95 and assembled for $219.95. For more information contact Trace Electronics Inc., 570 W. DeKalb Pike, King of Prussia, PA 19406, (215) 265-9220.

CIRCLE INQUIRY NO. 200

Intelligent Parallel Printer Interface Card from Apple

The Model A2B0002X Intelligent Printer Interface (IPI) Card gives Apple II owners hard copy from any popularly priced printer such as those offered by Axiom, Centronics, Qume, Printronics, OKI Data, SWTP and others.



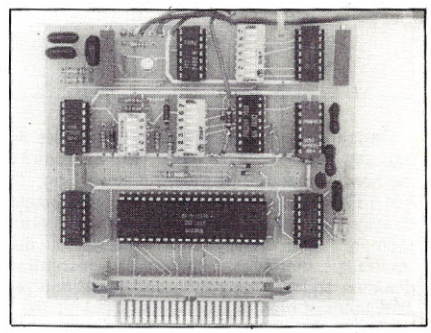
Apple owners can produce permanent copy of program listings, generate reports, print letters and labels and even generate graphics on printers with graphic capability.

The card is available from Apple dealers for $180. The card comes with firmware in ROM, printer configuration block, ribbon cable and complete instruction manual. For more information contact Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014, (408) 996-1010.

CIRCLE INQUIRY NO. 201

TRS-80 Serial I/O

This board is RS-232 compatible and can be used with or without the expansion bus. There are on board switch selectable baud rates of 110, 150, 300, 600, 1200, and 2400. Also parity odd or even or no parity.



The unit also had 5 to 8 data bits, and 1 or 2 stop bits and a D.T.R. line.

Price for the board only is $19.95 part no. 8010, with parts $59.95 part no. 8010A, assembled $79.95 part no. 8010C. For more information contact Electronic Systems, P.O. Box 21638, San Jose,CA 95151, (408) 226-4064.

CIRCLE INQUIRY NO. 202

Datasouth Lowers Price on Terminal Controller for LA36 DECwriter

Datasouth Computer Corporation has reduced domestic end-user and OEM quantity pricing on its DS120 Terminal Controller for the LA36 DECwriter.

The DS120, designed to upgrade the 300 baud LA36 to 1200 baud, has been reduced from $885 to $750 in single unit quantity. The 100 unit price has been reduced from $565 to $425.

The unit features microprocessor control, 165 cps bidirectional printing, forms control package, EIA and current loop interface, and 110-4800 baud line operation.

The DS120 is available from distributors in major cities throughout the U.S. and from Datasouth. For more information contact Datasouth Computer Corp., 627-F Minuet Lane, Charlotte, NC 28210, (704) 523-8500, Jim Busby.

CIRCLE INQUIRY NO. 203

PET IEEE-488 Serial Adapter

The PET IEEE-488 Serial Adapter makes it possible to interface RS-232C and 20ma compatible devices to the Commodore PET IEEE-488 expansion bus. This allows the PET owner to use a printer, a teletype, or even another keyboard with the PET, and also allows the use of the PET as an intelligent terminal.

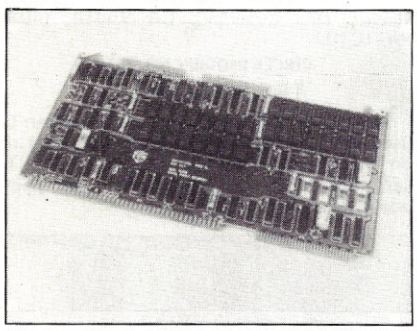
The serial adapter facilitates input as well as output and is designed to be fully compatible with the Hewlett-Packard Interface Bus (HPIN or IEEE-488). The PET IEEE-488 bus is extended to that other HPIB devices may be used with the PET ina ddition to the serial adapter.

A fully assembled and tested PET IEEE-488 Serial Adapter is available from Computer Systems for $220, plus $5 shipping costs in the U.S. For more information contact Computer Systems, P.O. Box 1846, Ames, IA 50010.

CIRCLE INQUIRY NO. 204

Subsystem Provides Two Computers Access to a Common Memory

The Datacube RM-117 Dual Port Memory Subsystem is Intel Multibus and NSC compatible. The RM-117 is a random access (read/write) subsystem with virtual memory that can support up to one megabyte of storage.



Designed for multi-processing, it provides two logically independent paths to a common memory. Internal memory address on the RM-117 is 20 bits wide and can be generated directly from the Multibus or through virtual memory. The basic board consists of dual Multibus interfaces, contention resolution, dynamic address translation and protection and 16K bytes of memory.

Price is $1200 each; 10 unit price is $995. For more information contact Datacube SMK Inc., 670 Main St., Reading, MA 01867, (617) 944-4600, J. Dunn, Marketing.

CIRCLE INQUIRY NO. 205

S-200 Interface

This S-200 interface provides the 9900 user with access to the S-100 bus, and the broad spectrum of S-100 accessories available. Although the main advantage of this scheme to the 9900 user will be lower-cost memory and disk I/O, it also provides video, speech synthesizer, relay controller, and other special purpose S-100 devices currently available.

The S-200 interface card is designed to plus into one S-100 motherboard and cable to another. It uses S-100 memory cards in pairs to provide 16-bit data transfers with no wait state with 450 usec memory.

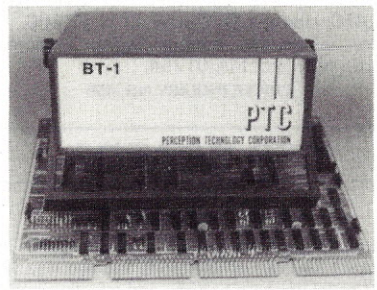
I/O cards can be used single or in pairs. The interface card can be cabled to Technico's 9900 CPU card. It can also be used with TI's 990 bus structure.

Board and manual price is $59.00. Kit, assembled and tested, and motherboard jumper available first quarter. I/O board available second quarter. For more information contact Interface Technology of Maryland, P.O. Box 745, College Park, MD 20770.

CIRCLE INQUIRY NO. 206

Printer Interface for Apple II

Computer World has a versatile solution for parallel printer interfacing to the Apple II computer. No need to load printer driver routine from cassette or disk. On board driver for all popular printers resides on a 2708 EPROM.



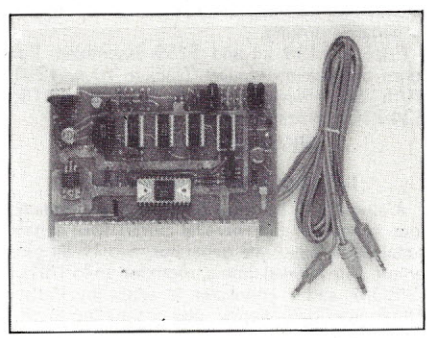
Fully programmable feature allows for complete handshaking and high speed parallel output.

Printer driver programs are available for 25 different printers. Complete assembled and tested, the printer interface includes printer card, 2708 EPROM (programmed for specific printer), 6520 or 6820 PIA, small breadboard area, socket and cable for printer interface and full documentation for $80. For more information contact Computer Components of Orange County, 6791 Westminster Ave., Westminster, CA 92708, (714) 898-8330.

CIRCLE INQUIRY NO. 207

Single Card Cassette I/O for SS50

SS50 bus compatible, the JF68 cassette I/O card occupies one I/O slot in any standard SS50 motherboard. Based around the Kansas City Standard recording technique, the card comes complete with three audio cables that plug directly into any low cost audio cassette recorder.



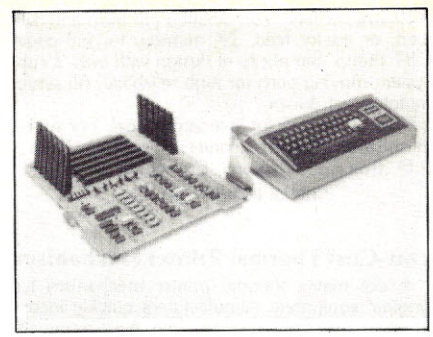
An opto-isolated control circuit connects to the "remote" input of the recorder for motor control of the cassette via a single write to a memory location. Operating on a single 5 volt supply, the card contains its own three terminal voltage regulator to provide all necessary power.

Price in kit form $49.95, fully assembled and tested $69.95. For more information contact JF Products, 1441-5 Pomona Rd., Corona, CA 91720, (714) 734-6900.

CIRCLE INQUIRY NO. 208

S-100 Adaptor for TRS-80

The 8100 is an S-100 bus adapter/motherboard for the TRS-80. The 8100 allows a Radio Shack TRS-80 computer to be interfaced to the popular S-100 bus for memory expansion and extended I/O capabilities.



The 8100 has its own built-in 6 slot motherboard which includes card guides which keep the boards in their places.

Price starts as $185. The basic unit includes S-100 bus interface and one edge connector/card guide set, manual, ribbon cable. $245 assembled and tested. For more information contact HUH Electronics, 1429 Maple St., San Mateo, CA 94402, (415) 573-7359.

CIRCLE INQUIRY NO. 209

Programmable Video Display Board

SS50 bus compatible, 80 characters by 24 line format, upper/lower case with true descenders, multiple character generators, user-program definable character sets.

Standard video output (either American or European standard). Contiguous 8x10 dot character grid. Multiple on-board character sensors. Two 128 character 2716 EPROMs. One 128 character fully CPU-accessible RAM.

Distinguishes between Control, Numeric, Uppercase, and Lowercase characters, in addition to the high order bit, providing 8 distinct character types.

High resolution (640 x 240) limited bit-map graphics capability. Straightforward screen memory layout — lines are stored as groups of 80 successive bytes and no empty space between lines.

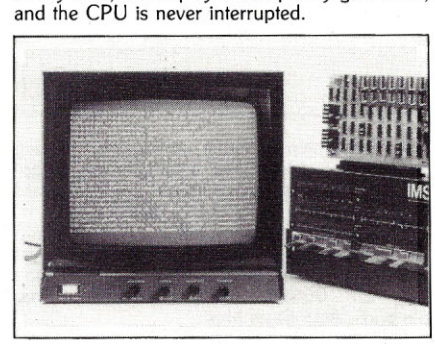
Vertical sync interval is readable by the CPU for clean screen scrolling and blanking. RAM character generator maybe accessed continuously by the CPU, or by a DMA device, without disturbing the screen image.

One EPROM with full standard ASCII plus control characters provided with board. For more information contact Gimix Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 927-5510.

CIRCLE INQUIRY NO. 210

ALTR-2480 Video Display Board

The ALTR-2480 is a 24 line by 80 character alphanumeric video interface card for the S-100 bus. With the new Matrox transparent memory design, the CPU can access the refresh memory at any time, the display is completely glitch free, and the CPU is never interrupted.



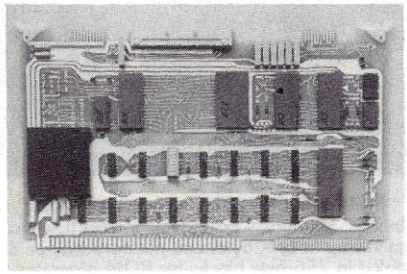
The method is completely general and does not rely on the peculiar timing characteristics of a particular CPU. All cards in the series feature memory mapped addressing.

Single price is $295; 100 quantity $265. Delivery is 2-4 weeks. For more information contact Matrox Electronic Systems Ltd., 2795 Bates Rd., Montreal, Que. H3S 1B5 Canada.

CIRCLE INQUIRY NO. 211

Analog Input/Output Board

This analog I/O board from Micro Networks Corporation offers 19 bits of dynamic range and interfaces electrically and mechanically with SBC-80/10, 80/20 and 80/30 microcomputers.



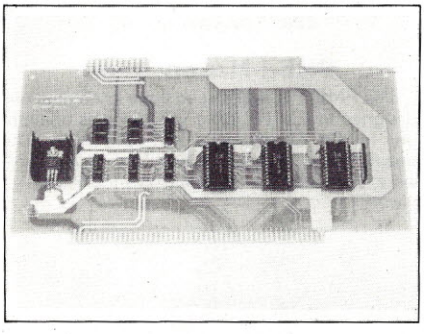
The standard MN7300 provides 16 input channels. With the optional multiplexer expander, the number of input channels can be increased to 32 single-ended or 16 differential. Two output channels with either voltage or 4-20mA outputs are also available.

The MN7300 is priced from $612 to $1,138 depending on options selected. Delivery is stock to four weeks. For more information contact Micro Networks Corp., 324 Clark St., Worcester, MA 01606.

CIRCLE INQUIRY NO. 212

I/O Card Interfaces Tester to S-100 Computers

Pragmatic Designs' IF-1 is an I/O card which interfaces their ICTM-1 integrated circuit tester module to S-100 bus computers. While intended as a dedicated interface, IF-1 can also be used as a general purpose I/O card in applications which require up to 16 output lines and 8 input lines.

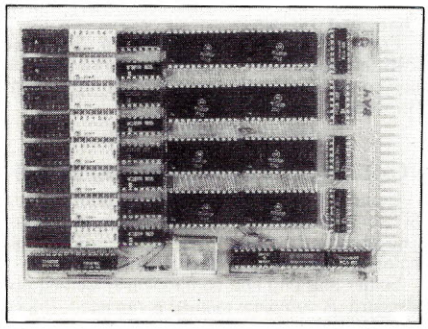


IF-1 is priced at $89.95 kit and $119.95 assembled and tested. Delivery is off the shelf. OEM discounts available. For more information contact Pragmatic Designs, Inc., 711 Stierlin Rd., Mountain View, CA 94043, (415) 961-3800.

CIRCLE INQUIRY NO. 213

Microcomputer Serial I/O Module

Eight RS-232C asynchronous serial I/O ports on a 4½" x 6½" industry standard module with 22/44 pin edge connector is available from Wintek Corporation. Each port supports all standard baud rates from 150 to 9600.

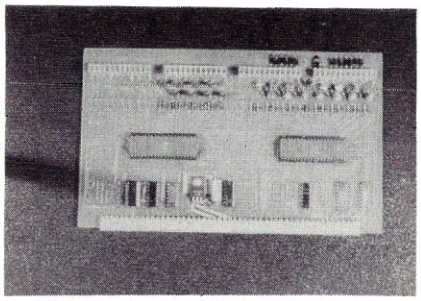


Baud rates are crystal controlled and individually switch selectable. The serial I/O Module can be supplied with 2, 4, 6 or 8 ports with unit prices of $99, $149, $199, and $249 respectively. OEM discounts available. For more information contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 214

Parallel Interface

Ths VPI-1 (for Versatile Parallel Interface) is a 4 port I/O board for the 50 pin S-50 bus. It can be used to interface keyboards, printers, reader-punches, Selectric typewriters, relays, solenoids, etc. to CPU systems using this bus.



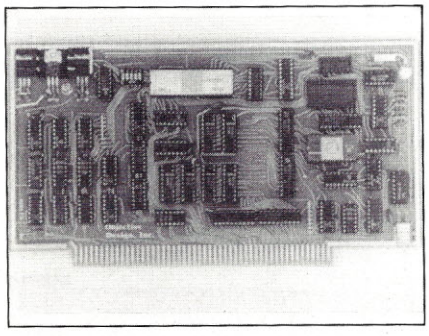
It uses 2 MC6820 peripheral interface adapters or 2 MC6522 versatile interface adapters or one of each to give a total of 40 I/O lines, 36 of which can be input or output and 4 that are input only.

Bare board price is $32.50 plus $2.50 per order shipping and handling. Documentation only $5 ppd. For more information contact F&D Associates, 1210 Todd Rd., New Plymouth, OH 45654, Floyd Largent, Advertising Manager.

CIRCLE INQUIRY NO. 215

Absolute Video Control

A new S-100 compatible Video Display Interface (VDI) provides unequalled software control of screen presentation. The video board will create alphanumeric displays of 80x24, 64x16, 64x32, 40x20 and many other formats — all selected by programming.



The character set is programmed in PROM, which can be replaced by the user. Each individual character has reverse video and 4 levels of gray scale.

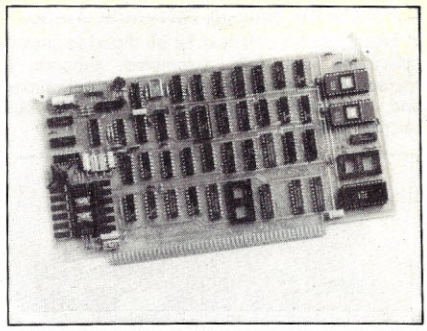
For more information contact Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304.

CIRCLE INQUIRY NO. 216

Video Board Features High Density and Reverse Video

Displaying 80 characters x 24 lines, the new FLASHWRITER II™ uses an 8x10 dot matrix to produce crisp, sharp resolution for 1920 character positions in a 2048 memory block.

In addition to normal video, reverse video is optionally controlled by the higher order bit of the character code.

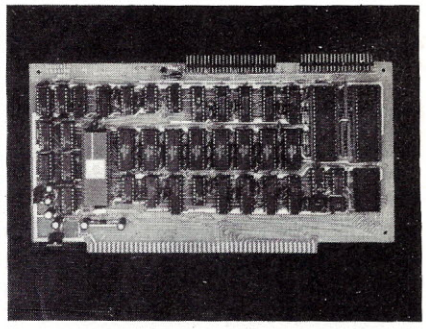


The FLASHWRITER II is priced at $320 assembled and is available from all authorized Vector Graphic dealers. For more information contact Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361, (213) 991-2302.

CIRCLE INQUIRY NO. 217

Complete I/O Board

A single S-100 bus compatible board from Micromation can handle an S-100 system's complete I/O requirements. This board includes a 24 line by 80 character video driver, 24 programmable parallel I/O lines, 24 dedicated output lines with bus driving outputs, a UART with RS-232 interface, and one Kbyte of EPROM.



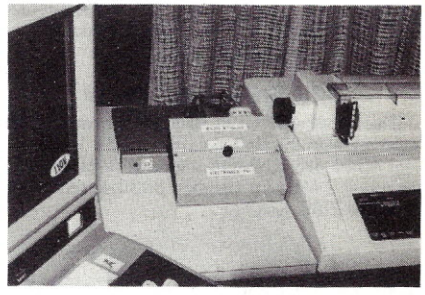
The video driver provides all functions necessary to interface a standard video monitor to an S-100 system. The full upper and lower case ASCII character set is available.

Price is $395. For more information contact Micromation Inc., 524 Union St., San Francisco, CA 94133, (415) 398-0289.

CIRCLE INQUIRY NO. 218

RS232 Switching Units

The RS232-X family of low-cost miniature switching units is a unique concept in switching RS232 peripherals, between several driving sources (computers, CPUs, etc.)



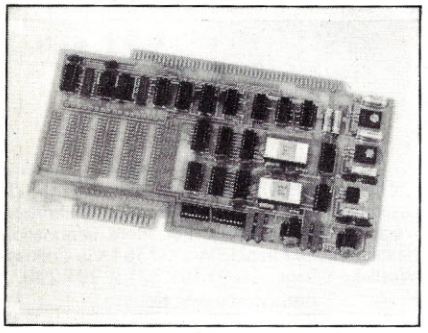
The RS232-X3 allows the connection of an RS232 peripheral to three driving sources. A unique arrangement allows the cascading of two or more RS232-X switches, thereby expanding the selection from 3 devices to 5 or more devices.

Single quantity prices start at $47.95 in kit form. Delivery is stock to 4 weeks. For more information contact Giltronix, 3156 Avalon, Palo Alto, CA 94306, (415) 493-2199.

CIRCLE INQUIRY NO. 219

Precision Analog Interface Board

This PAIB features two 12-bit digital-to-analog converters and, fully assembled, supports a myriad of measurement and control applications and is compatible with most S-100 bus microprocessors.



Two analog output channels and a variety of output voltage ranges allow operation in either monopolar or bipolar modes.

Price is $390 retail. For more information contact Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361, (213) 991-2302.

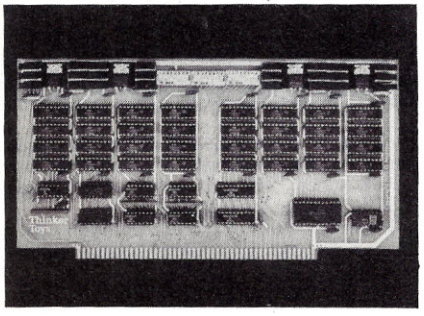
CIRCLE INQUIRY NO. 456

MEMORY BOARDS

16K Static RAM

SupeRam™ 16 is a 16K static memory board for S-100 microcomputer systems.

SupeRam 16 is a complete kit featuring four independently addressable and write-protectable 4K blocks.



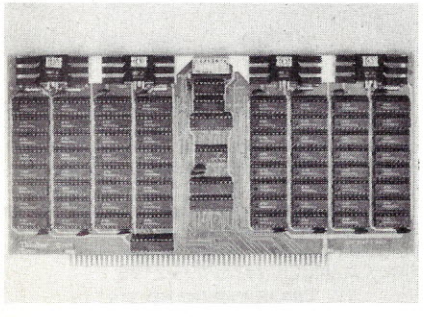
The super-efficient design uses just eleven ICs to keep the board uncrowded and trouble-free. The board was designed to meet the proposed IEEE Standard for S-100 bus systems. All signals are fully buffered, including address and data lines.

Price is $299. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-5317, Neila Richmond.

CIRCLE INQUIRY NO. 220

32K Static RAM Board

The SupeRam™ 32K static RAM board S-100 memory uses the National 5257 or the TI equivalent 4044 4Kx1 NMOS memory chips and can be run at 2 MHz for standard 8080 systems or 4 MHz for Z-80 systems.



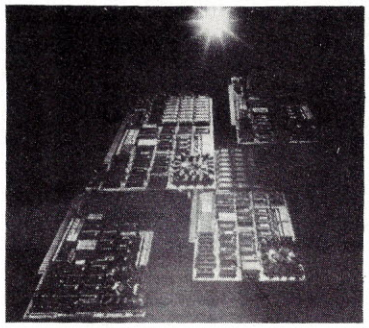
A phantom option has been provided for CPUs using this line. All control signals, addresses and data lines are fully buffered. Each 16K block is independently addressable and write protected. This board contains only 7 support ICs and the typical power consumption is 2.6 amps.

Prices are $649 kit, $699 assembled. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-2101, Hilda Sendyk.

CIRCLE INQUIRY NO. 221

Dynamic RAM Boards

The nKRA RAM boards from Processor Technology are available with 16K, 32K, 48K and 64K bytes. ICs are mounted in sockets. Refresh is synchronous, so no wait states can slow the microprocessor.



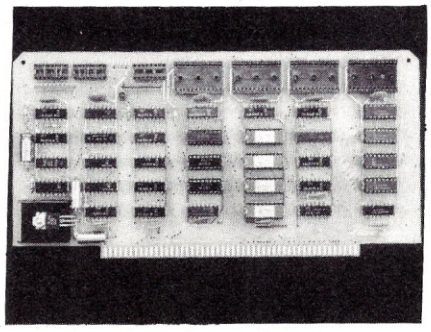
Board design permits future incorporation of bank select option. With bank select, memory may be expanded far beyond 64K bytes with all memory on-line continuously.

Prices range from $429 to $1350. Delivery is stock to 30 days. For more information contact Processor Technology Corp., 7100 Johnson Dr., Pleasanton, CA 94566.

CIRCLE INQUIRY NO. 222

Memory Card Adds Development Capability to Existing Micros

DBM-1 is a memory card that allows any S-100 type computer to be used as a memory emulator during program development for small, dedicated systems.



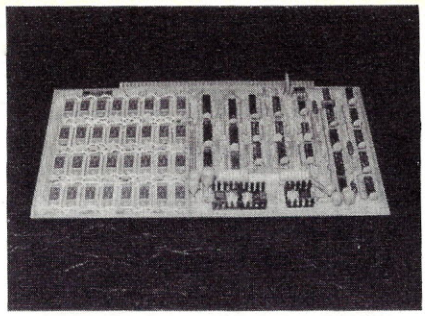
The DBM-1 is a 2K byte memory card which can be accessed by both a development computer and an application computer. The development computer loads the memory with the applications program.

Price for DBM-1 is $190 kit and $270 assembled and tested. Description manual is $8, refundable with order. For more information contact Pragmatic Designs, Inc., 711 Stierlin Rd., Mountain View, CA 94043, (415) 961-3800.

CIRCLE INQUIRY NO. 223

64K RAM Card

Microcosm, Inc. has a 64K RAM card that reduces system card count by using only one S-100 card slot. It uses only as much power as the standard 16K RAM card.



Buffered signal lines mean less loading on busses. Memory is expandable in 16K byte increments up to 64K bytes and memory may be disabled in 256 byte blocks for ROM programs.

The fast cycle time of the new 16x1 dynamic RAM means no wait states are needed for reads, writes or refreshing. Memory card handles refresh.

For more information contact Microcosm Inc., 534 W. 9460 S., Sandy, UT 84070, (801) 566-1322.

CIRCLE INQUIRY NO. 224

16K Static RAM for S-100 Bus

Micro Diversions announces a 16K Static Memory Board featuring the industry standard 2114 static RAM, Scmitt triggered buffers, independent dip switch mapping of each 4K memory block.

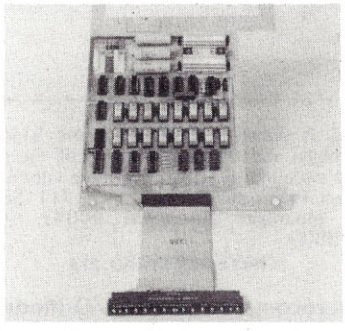
Also included are from 0 to 6 wait states selectable, for compatibility with today's and tomorrow's CPUs, and highest quality components.

Prices are $35 unpopulated, $349 kit, $395 assembled and tested. Add $30 for 300 nsec memory (4 mhz operation). For more information contact Micro Diversions Inc., 8455-D Tyco Rd., Vienna, VA 22180, (703) 827-0888.

CIRCLE INQUIRY NO. 225

PME-1 Memory Board

The PME-1 is available in three configurations designed to add 16, 24 or 32 kilobytes of memory to the Commodore PET computer. The board comes complete with all necessary hardware, and requires no electrical modification of the PET.



The memory board derives its power from the PET transformer (but not from PET regulators). The 24K version allows the writing of programs to the total capacity of the PET. The 32K permits the storage of protected machine language programs and displays.

Price is $420 for the 16K board, $525 for 24K, and $615 for the 32K. For more information contact Computer Mart Systems, 13 E. 30th St., New York, NY 10016.

CIRCLE INQUIRY NO. 226

C/T-32/16K Static Memory Board

Compu/Time has a low cost high performance S-100 bus 32K or 16K static memory board. The PC board is epoxy glass with plated through holes and flashed gold edge connector.

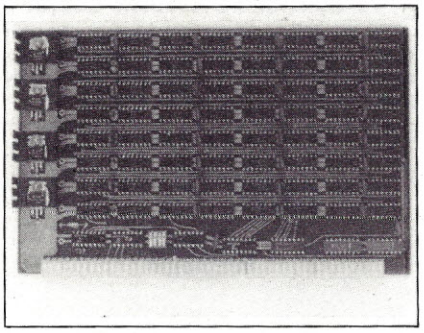
Solder masking and component screening are standard. A complete manual is provided. Prices are available upon request.

For more information contact Compu/Time, P.O. Box 417, Huntington Beach, CA 92646, (714) 536-5000.

CIRCLE INQUIRY NO. 227

8K RAM Card for SS-50 Systems

The card utilizes 2102 type static memories for the lowest cost per bit compromise. A four position DIP switch selects one of four possible page addresses in the system.



Three terminal voltage regulators are used to supply all power to the RAM chips and decode circuitry. Fully buffered, the card presents only one TTL load to the systems' bus.

The board material is constructed of glass-epoxy with plated through holes and solder mask. Prices are $159.95 for kit, $59.95 for kit excluding RAM chips, or fully assembled and tested for $199.95. For more information contact JF Products, 1441-5 Pomona Rd., Corona, CA 91720.

CIRCLE INQUIRY NO. 228

4K by 1 Static RAM

A high-speed, low-power 4096-bit static random access memory organized 4096 bits by one bit with an option for power down is now available from Advanced Micro Devices.

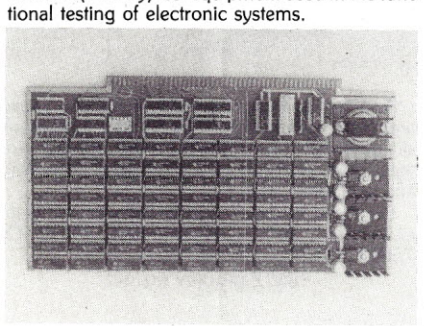
The N-channel Am9044 offers access times as fast as 200 nanoseconds. The Am9244 offers an automatic chip select power-down feature.

Both devices are fully static, and available in 18-pin plastic and ceramic dual-in-line packages. Prices are $9.65 in 100-unit lots. They are available from Hamilton/Avnet and Schweber and Arrow, Bell, Century, Future, Liberty/Elmar, RAE, Sheridan and Summit. For more information contact E. Sopkin, (408) 732-2400.

CIRCLE INQUIRY NO. 229

Static Memory System

The Computation Company has available its Static Memory System originally designed as part of DOD (military) test equipment used in the functional testing of electronic systems.



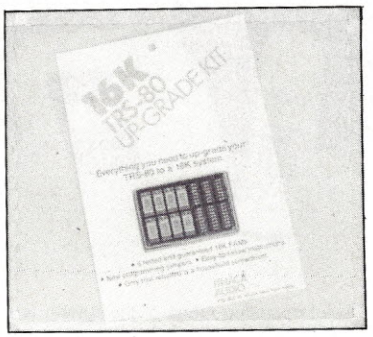
The memory consists of 4044 chips and includes all peripheral circuits plus on-board regulators and is completely buffered. The 32KB system uses the S-100 bus structure and the single supply requires less than 3500 mA.

Price for TCC32K-450 (450 us) is $699, and TCC32K-250 (250 us) $764. For more information contact The Computation Co., 5185 Mercury Pt., San Diego, CA 92111, (714) 560-6117.

CIRCLE INQUIRY NO. 230

Upgrade TRS-80 to 16K RAM

The Ithaca Audio 16K TRS-80 Upgrade kit supplies everything needed for fast, reliable memory expansion. No soldering is required. The kit comes complete with preprogrammed jumper shunts for both Level I and Level II machines and eight fully-tested 16K dynamic RAMs.



The RAMs are simply plugged into the keyboard or expansion module of the TRS-80. Suggested Retail price is $140 and is available through Ithaca Audio dealers. For more information contact Ithaca Audio, P.O. Box 91, Ithaca, NY 14850, (607) 273-3271.

CIRCLE INQUIRY NO. 231

Add-On Memory for PET

Plessey Microsystems has an add-on memory for the Commodore PET. Called Petite, this self contained module expands the PET to its full capability and allows more complex programs to be run as well as providing an extension to the graphics facility.

The random access memory incorporated in the Petite is organized as 24K bytes in its standard form. Alternative configurations are available from 8K bytes, which is the minimum useful configuration, through 32K bytes which provides additional storage for long machine language programs and display storage.

Each system comes complete in its own compact portable case and has been designed to interface directly to the PET memory port. It is supplied with mating connectors to expand the PET without any modification. Unlike add-in units, there is no need to even open up the PET cabinet and consequently it does not adversely affect the power drain or heat dissipation within the PET.

Plessey Microsystems will handle orders from PET users directly. Current end user price is set at $875 for a 24K byte unit complete with leads, connectors, detailed technical handbook and six month warranty.

For more information contact Plessey Microsystems, 19546 Clubhouse Rd., Gaithersburg, MD 20760.

CIRCLE INQUIRY NO. 454

MODEMS

Superphone

Superphone is a standard size pushbutton phone that easily connects to any phone line —

rotary dial or touchtone. It's a 4-function calculator that can be used at any time — even when you're talking. Calculations appear on the bright LED display.

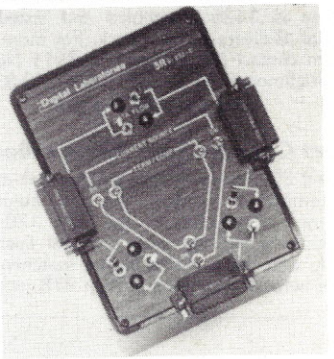
It stores up to 20 phone numbers, including area and access codes, and dials them automatically. It redials the last number automatically if you get a busy signal.

Superphone 7700 comes in five colors that can be combined with complimentary face plate colors. Price is $229.95. For more information contact I.C.P. Marketing, 3031 Tisch Wy., Suite 750, San Jose, CA 95128, (408) 247-7700.

CIRCLE INQUIRY NO. 232

Interface Connects Several Computers — Permits Direct Data Transfer

The Digital 3R Universal Junction Unit is a compact connection box that permits direct communication between serial devices.



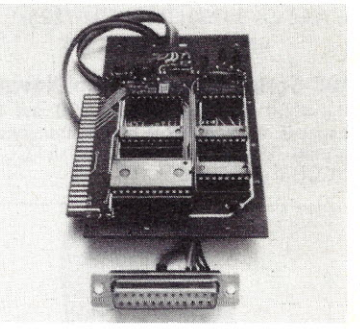
It incorporates three ports; each has switches to interchange transmit and receive signals, and establish operation in the RS232C or 20mA mode.

Price is $350. For more information contact Digital Laboratories Inc., 600 Pleasant St., Watertown, MA 02172, (617) 924-1680, William Kahn.

CIRCLE INQUIRY NO. 233

Intelligent Communication Interface

The ICI A2B0003X offers low cost telephone communications for the deaf; inexpensive high speed message transfer to a friend or business associate; remote system failure diagnostics; access to massive data banks and program libraries by phone and more.

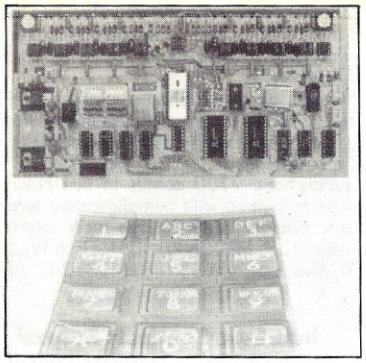


The interface can be connected to any device which will accept RS-232C serial interface. Price is $180 complete with cable and operation manual. For more information contact Apple Computer Inc., 10260 Bandley Dr., Cupertino, CA 95014, (408) 996-1010.

CIRCLE INQUIRY NO. 234

MK-II Interface Board

The Dual Tone Multi-Frequency (DTMF) transceiver board interfaces S-100 microcomputers to the Touch-Tone telephone. The board converts Bell System's DTMF into binary and binary into DTMF, making a fully operational Touch-Tone transceiver.



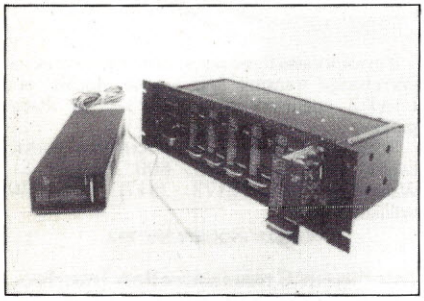
On incoming calls, vectored interrupts allow for ring detection as well as detecting the presence of DTMF signaling. On outgoing calls, digits dialed are loaded into a FIFO buffer at processor speed and unloaded into a DTMF generator.

Price is $425 assembled and tested with manual. Delivery is from stock. For more information contact MK Enterprises, 8911 Norwick Rd., Richmond, VA 23229, (804) 740-8380.

CIRCLE INQUIRY NO. 235

Direct Connect Auto Answer Modem

The P-202S is a two-wire, simplex/half-duplex Bell-compatible modem for the automatic answering of a computer call. The 1200-bps modem is a direct-connect unit that interfaces directly with the two-wire dial-up switched telephone network through a 97A or 97B jack.



A Data Access Arrangement (DAA) is not required. The card version is priced at $340 single. Stand alone version — card and power supply — is priced at $455 single. For more information contact Prentice Corp., 795 San Antonio Rd., Palo Alto, CA 94303, (415) 494-7225.

CIRCLE INQUIRY NO. 236

4000 Series Modems from Novation

The 4000 Series modems in 300 and 1200 bps speeds are available in both stand alone and rack units. The 4000 Series meets all FCC, EIA and CCITT standards.

In addition, an expandable rack arrangement can accommodate up to 16 active modem cards. For more information contact Novation, Inc., 18664 Oxnard St., Dept. P1, Tarzana, CA 91356, (213) 996-5060, Tom Goslin, Mkt. VP.

CIRCLE INQUIRY NO. 237

PACE Ez Phone

The Pace Ez Phone is a wireless extension telephone entirely enclosed in a handset with collapsible whip antenna, touch-tone dialing pad and two special-function switches.

Useful operating range of the system is about 300 feet, and several remote phones can be used with the same base unit.

Price is $169.95 per unit. For more information contact Pathcom, Inc., c/o Walter Salm Associates, 479 Green St., Woodbridge, NJ 07095.

CIRCLE INQUIRY NO. 238

Porta-Tel™ Modular Accessories

Printer Attachment provides easy to read messages on a 5½" continuous paper roll with 48 characters for a permanent record of all conversations.

Carrying Case to protect the Porta-Tel while traveling. Adjustable strap allows it to be carried as a briefcase or shoulder bag.

RecordaTel is an automatic answering device specially engineered to work with the Porta-Tel to record all incoming calls from any TDD/TTY. Cassette Recorder is designed to record both ends of a conversation. Ring Signaler is a practical, reliable visual phone ringing alert system.

For more information contact Specialized Systems, Inc., 11558 Sorrenta Valley Rd., Bldg. 7, San Diego, CA 92121.

CIRCLE INQUIRY NO. 239

Acoustic Coupler/Modem

The TC3002 is a Bell compatible 103F and 113A unit. The TC3002 provides all of the portability of an acoustic coupler and the reliability of a state-of-the-art modem.

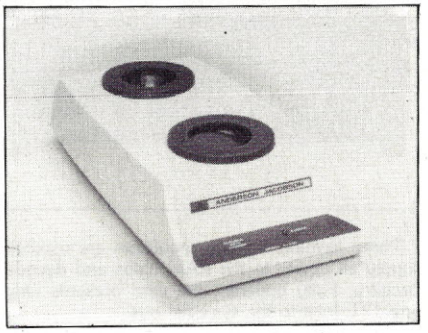
The TC3002 has been designed to optimize the transfer of low-speed data over normal voice grade telephone lines using an ordinary telephone handset.

Unit one price is $295. Delivery is 15 days ARO. For more information contact Tek-Com Inc., 1147 Sonora Ct., Sunnyvale, CA 94086, (408) 736-3282, Robert Way, President.

CIRCLE INQUIRY NO. 240

TTL-Compatible Acoustic Coupler

The AJ 243 is designed to interface with transistor-to-transistor logic (TTL) teleprinter terminals. The AJ 243 is compatible with any low speed terminal utilizing a TTL interface.



Cables are available for connection to either Teletype's Model 43 or DEC's LA-36 DECwriter. The AN 243 offers full duplex 103/113 compatible operation at speeds up to 450 bps.

Quantity one price is $265. Discounts for quantity purchases available. For more information contact Anderson Jacobson, Inc., 521 Charcot Ave., San Jose, CA 95131, (408) 263-8520.

CIRCLE INQUIRY NO. 241

ENVAX™

ENVAX 1000 Series is a micro communicating computer system, plug compatible with any simple EIA RS-232 terminal. The unit features direct interface to TELEX, TWX, DDD and private line networks.

Also featured are computer controlled speed and code conversions. ENVAX incorporates all standard data/telecommunications terminal protocols and offers text editing, operator prompting and application software.

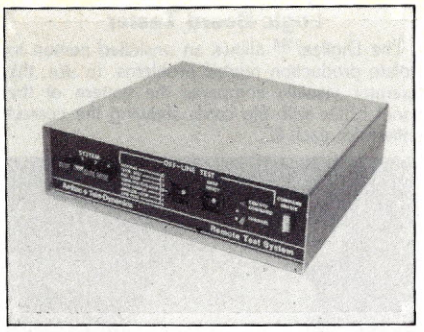
For more information contact Vardon & Associates, Inc., 930 N. Beltline Rd., Irving, TX 75061, (214) 252-7502.

CIRCLE INQUIRY NO. 242

TEST EQUIPMENT

Remote Test System

A remote test system from Tele-Dynamics permits central testing of communications networks using as many as 120 remote Tele-Dynamics 7208A modems. All commands are made from a single control location without operator attendance at the remote sites.



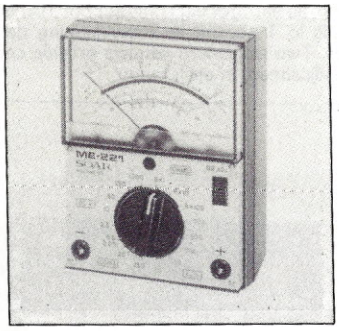
Tele-Dynamics 7208A is a 4800-bps modem for use on private lines. It is fully compatible and completely interchangeable with the Bell 208A Data Set. A printed circuit card in each remote 7208A modem gives that modem remote-test capability.

For more information contact Tele-Dynamics Div., of Ambac Industries, Inc., 525 Virginia Dr., Ft. Washington, PA 19034, (215) 643-3900.

CIRCLE INQUIRY NO. 243

Low-Cost Analog Multimeter

The drop-proof battery-operated ME-221 multimeter has a rugged taut band movement that absorbs shocks to 50 Gs. Other features include a wide-scale meter deflection angle of 95 degrees, a mirrored scale for easy reading, four function modes — DCV, ACV, DCmA, and Ohms — and high accuracy and stability.



This accurate and completely portable instrument has a voltage measurement range to 1000 VDC and VAC, a current measurement range to 250 ma, and a resistance measurement range to 500 kilohms.

Price is $30. Delivery from stock. For more information contact Soar Electronics Corp., 813 2nd St., Ronkonkoma, NY 11779.

CIRCLE INQUIRY NO. 244

TTL or CMOS Digital Comparator

The Model 316 is a ± digital comparator with built-in thumbwheel switches and relay output. The Model 316 compares a ±3½, ±4½, 5 or 6 digit parallel bit word with the selected settings on the thumbwheel switches.

The Model 316 is designed as a stand alone unit or a companion module to the IMC Series A300 DPMs. Both are designed to fit in the same IMC standard dimension case which can be used for either front or rear mounting.

Single unit price is $99 for the TTL model and $134 for the CMOS compatible unit. Delivery is stock to 4 weeks. For more information contact International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714, (602) 748-7900.

CIRCLE INQUIRY NO. 245

500 MHz Prescaler

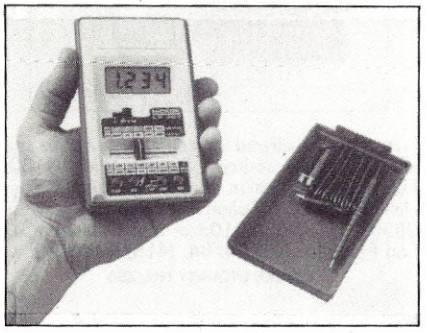
Continental Specialties is now marketing a PS-500 MHz frequency Prescaler. The PS-500 Prescaler has been designed to complement CSC's MAX-50 and MAX-100 frequency counters.

Suggested price is $59.95. For more information contact Continental Specialties Corp., 70 Fulton Terr., New Haven, CT 06509, (203) 624-3103 or 351 California St., San Francisco, CA 94104, (415) 421-8872.

CIRCLE INQUIRY NO. 246

Personal Size DVOM

The LX 303 is a 3½ digit pocket-sized digital multimeter for electrical/electronic test, calibration, and field service applications.



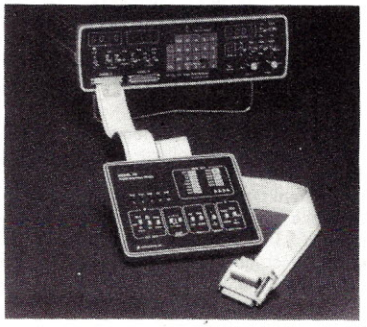
Features include auto-polarity, auto-zero and automatic overage indication. Ruggedness is achieved by a combination of light weight, compact size, high-impact thermoplastic case, and glass-epoxy pc board construction.

Price is under $75. For more information contact The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, OH 44108.

CIRCLE INQUIRY NO. 247

Serial Interface Probe

The Model 70 Serial Interface Probe offers a cost-effective way to convert the Model 532 Intelligent Logic State Analyzer into a powerful tool for testing asynchronous RS-232 and 20mA current loop interfaces.



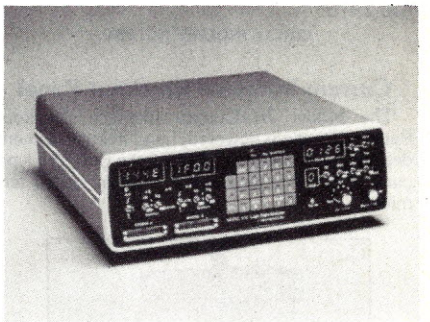
The Model 70 operates in both receive and transmit modes. In the receive mode, all that is required is the Model 70 plugged into a basic Model 532 in place of one of the analyzer's 16 channel data input probes.

Price is $390. Delivery is stock to 4 weeks. For more information contact Paratronics, Inc., 800 Charcot Ave., San Jose, CA 95131, (408) 263-2252.

CIRCLE INQUIRY NO. 248

IEEE-48 Capability Added to Logic State Analyzer

Paratronics has an interface board which permits the Model 532 Intelligent Logic State Analyzer to function as a listener/talker on the IEEE-48 bus.



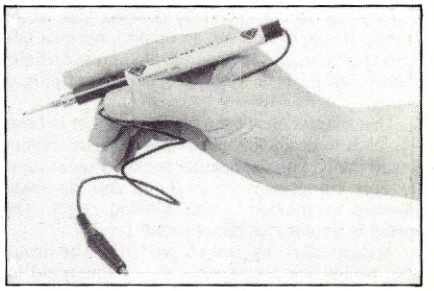
The optional board plugs into any available slot on the Model 532's internal microprocessor bus and allows all front panel functions to be operated remotely from an IEEE-488 controller. All 32 channels by 250 words of data collected by the analyzer can be sent back to the controller or to any other device on the IEEE-488 bus.

The IEEE-48 interface option adds $350 to the Model 532's base price of $1800 (plus probes). Delivery on both is 4-6 weeks ARO. For more information contact Paratronics, Inc., 122 Charcot Ave., San Jose, CA 95131, (408) 263-2252.

CIRCLE INQUIRY NO. 249

Activity Probe

Pencil Activity Probe (PAP) is a unique, low-cost EIA RS-232 test set. PAP is a pencil sized logic probe for checking RS-232 levels. PAP can be used to check any lead for high, low or positive clock indications, as well as ground or broken connections.



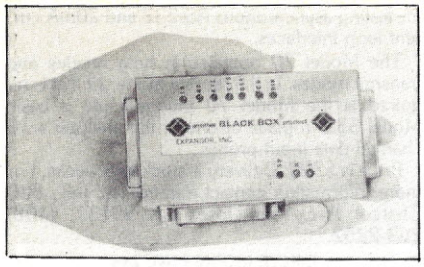
The probe tip fits female RS-232 sockets and the ground clip stores in PAP's case. PAP may also be used for checking TTL levels.

For more information contact Expandor Inc., 400 St. Claire Plaza, Upper St. Clair, PA 15241, (412) 746-2910.

CIRCLE INQUIRY NO. 250

SAM Monitor

Expandor's Status Activity Monitor (SAM) is designed for testing and monitoring RS-232 interfaces. SAM can easily be carried in a pocket for use as a testing device, or mounted onto the interface circuit as a temporary or permanent monitor.



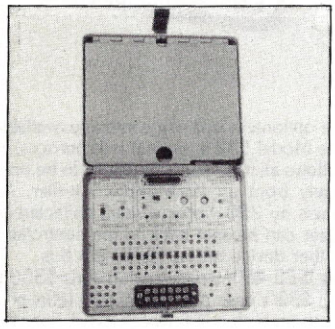
A third connector is provided for additional testing of terminal equipment. SAM's nine LEDs indicate activity on the 7 most common RS-232 leads. Two additional LEDs indicate high or low level, or positive clock indication.

Price is $95 with a one year warranty. For more information contact Expandor Inc., 400 St. Claire Plaza, Upper St. Clair, PA 15241, (412) 746-2910.

CIRCLE INQUIRY NO. 251

Current Interface Breakout Panel

The Model 70 Current Interface Breakout Panel is a battery powered, hand held instrument designed to monitor and breakout a Bell 303 type current interface between a modem and a terminal.



For operation the current interface cable at a standard connector is unplugged and plugged into the Model 70.

The Model 70 is priced at $990. Delivery is 30 days ARO. For more information contact International Data Sciences, inc., 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.

CIRCLE INQUIRY NO. 252

ISEE™ IC Adapter

Did you ever accidentally connect Vcc to the wrong IC pin or burn up an op amp because you shorted the output to ground? Do you sometimes "lose" an IC in a maze of patch board jumper wires?

This adapter allows the circuit designer to bring IC leads to easily identified banana jacks. Simply insert the IC into the adapter socket. Power supply and component connections can be made directly to molded 3-way binding posts. The result is an easy to follow circuit layout.

Accepts all 8, 14 and 16 pin DIPs. The device can be use for prototyping, as a training aid, or made into an IC tester.

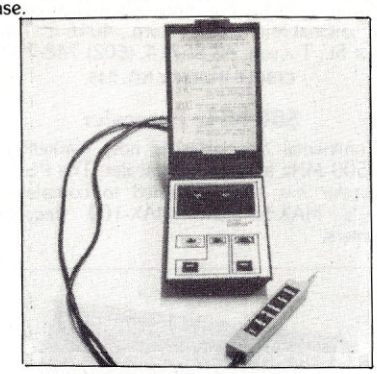
For more information contact Active Design Laboratories, Box 7R, W. Hartford, CT 06107.

CIRCLE INQUIRY NO. 252

Signature Analyzer Logic Tester

A low-cost hand held digital signature analyzer product family gives microprocessor and LSI circuit troubleshooting capability to designers, manufacturing and service technicians of computers and peripherals for the hobby and small business markets.

The LS-120 fits in the hand and is designed for rugged use in all types of environments, consumer to industrial. Options include an Active Probe with State LEDs for additional troubleshooting capability, remote control and carrying case.



Price for LS-120 starts at $349. For more information contact Phoenix Digital Corp., 7745 E. Redfield Rd., Scottsdale, AZ 85260, (602) 991-6360, Gerald Trussell.

CIRCLE INQUIRY NO. 254

MAX-550 MHz Counter

The MAX-550 is a palm-size frequency counter that has a 1 KHz to 550 MHz range. The 6-digit LED display features 1KHz resolution.

Accessories offered include cables, a case and alternate power sources. Price is under $150. For more information contact Continental Specialties Corp., 70 Fulton Terr., New Haven, CT 06509, (203) 624-3103 or 351 California St., San Francisco, CA 94104, (415) 421-8872.

CIRCLE INQUIRY NO. 255

Low-Cost Portable DMM

The Model ME-521DX multimeter is a 3½-digit battery powered unit. It features a high-low ohm switch for all ranges, five function modes, automatic zero adjustment, automatic polarity, and overload protection.

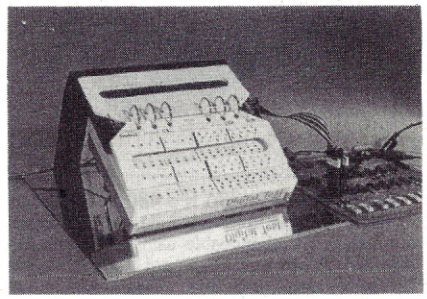
Low current drain assures long battery life. This portable device has a voltage measurement capability to 1000 VDC and 600 VAC, a current measurement range to 1000 ma (AC or DC) and a resistance measurement range to 20 megohms.

Price is $115. Delivery from stock. For more information contact Soar Electronics, 813 2nd St., Ronkonkoma, NY 11779, (516) 981-6444.

CIRCLE INQUIRY NO. 256

Logic Board Tester

The Digilzer™ allows an unskilled person to isolate production related problems. In use, the operator visually compares the pattern of the panel LEDs with flip cards showing the correct pattern for each IC.



For each pin, LEDs indicate not only the logic level, but if the pin is shorted to ground, or below, positive supply, or above, or invalid. Any discrepancies can easily be interpreted to be a broken trace, a trace shorted to a power supply, ground, or another singal trace, or a faulty, wrong value, missing or otherwise incorrect component.

For more information contact Digital Test, Inc., (617) 245-8200, Ronald Todd.

CIRCLE INQUIRY NO. 257

Pulse Generator

The Model 4001 offers independently variable pulse width and spacing controls from 100 nanoseconds to 1 second in 7 overlapping decade ranges. Two single-turn verniers provide continuous adjustment in each range.

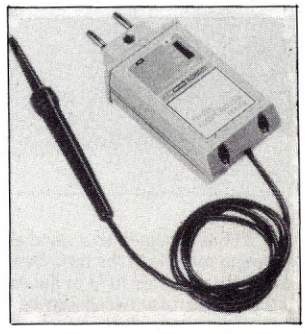
The six pushbutton-selectable modes are RUN, TRIGGER, GATE, SINGLE-SHOT, SQUARE WAVE and COMPLEMENT.

Price is $149.95. For more information contact Continental Specialties Corp., 70 Fulton Terr., New Haven, CT 06509, or 351 California St., San Francisco, CA 94104.

CIRCLE INQUIRY NO. 258

Temperature Probe Converts Voltmeter to Thermometer

The Model TP-28 is a solid-state temperature probe which can measure to 0.01 °C with analog and digital voltmeters.



The Model TP-28 can save time in electronic and electro-mechanical servicing by quickly spotting components that are running too hot. The TP-28 will operate for over 120 hours on a 9-volt transistor radio battery. An automatic low battery indicator is included.

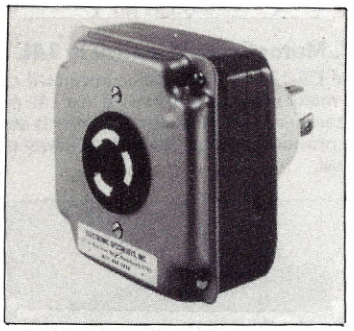
Price is $75. For more information contact B&K-Precision, 6460 W. Cortland St., Chicago, IL 60635, (312) 889-9087.

CIRCLE INQUIRY NO. 259

POWER SUPPLIES

Twist*Protect

AC Power Line Surge Suppression is quickly and easily installed at 125 VAC NEMA Twist-Type power outlets with Twist*Protect from Electronic Specialists.



Twist*Protect absorbs up to 2000 amp, 20 microsecond pulses to protect against lightning or man-made power line surges.

Providing line-to-line and line-to-ground protection, Twist*Protect plugs into the NEMA 125 VAC twist-type wall socket and equipment is plugged into the Twist*Protect socket.

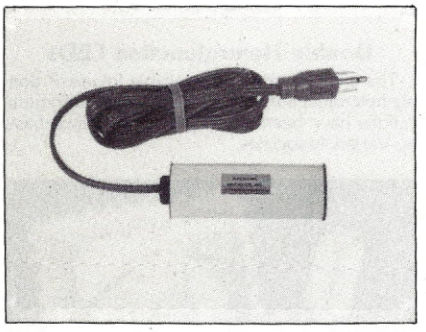
For more information contact Electronic Specialists, Inc., Box 122, Natick, MA 01760.

CIRCLE INQUIRY NO. 260

Glitch Killer

Glitches, false print-out and memory loss are often caused by lightning and machinery surges or AC power line hash.

The AC Line Cord Suppressor/Filter from Electronic Specialists will bring glitch causing hash and surges under control.



Capable of handling up to a 1000 watt load, the line cord suppressor/filter provides both line-to-line and line-to-ground protection.

Model S/F-KW-3 priced at $24.50. For more information contact Electronic Specialists, Inc., Box 122, Natick, MA 01760, (617) 655-1532.

CIRCLE INQUIRY NO. 261

Power Supply

The Might-1™ power supply delivers one full amp of DC current. This laboratory grade fixed voltage dual output supply delivers Dc power to within ±2% of the rated output. AC ripple is less than 0.1% of the DC level.

Output stage is protected against accidental short circuits. This power supply features a lighted on/off switch and is circuit breaker protected. The unit comes fully assembled and tested. The three output terminals are sturdy color-coded Lexan binding posts.

Available outputs are ±12; ±5; +5 and +12.

For more information contact Active Design Laboratories, Box 7R, W. Hartford, CT 06107.

CIRCLE INQUIRY NO. 262

Computer Transient Protection

A line of HDA Power Master transient voltage suppressors for the protection of delicate computer instruments is available from W.N. Phillips, Inc. The Model OEM MC120-1N-A and model PE120-1N twist lock supressor, dissipate destructive electrical transients that invade electrical systems.

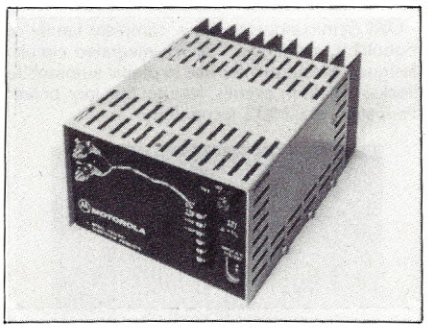
Both feature solid-state semiconductor components which react within pico second response time. Units are available in voltages from 120/240 single phase to 480 volts 3-phase.

For more information contact W.N. Phillips Electronics, Inc., 356 Bacon St., Box I, Lake City, MI 49651, (616) 839-7181.

CIRCLE INQUIRY NO. 263

Multiple Output Switching Power Supplies

The 1800 series are 400-watt, 25kHz pulse-width modulated power supplies designed for users of microprocessors, small computers and numerical control equipment.



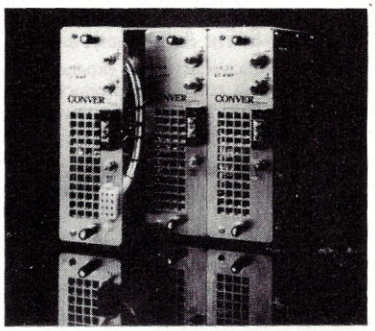
PSN1801 single output model has 5VDC output voltage and 80A max output current and is priced at $495 in quantities 1 to 9. PSD1802 dual output model main output voltage is 5VDC with 60A max output current. Price is $560 for 1-9. PST1803 triple output model main output voltage is 5VDC and 60A max output current. Price is $1625 for 1-9. For more information contact Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 244-3103, Nick Freyling.

CIRCLE INQUIRY NO. 264

Series 6000 Advanced Multi-Output Switching Power Supply

Sophisticated state-of-the-art packaging approach results in a modular design triple-output power supply that assures greater reliability and cost savings.

Pluggable modules allow field-replaceability in minutes. Performance features include digital remote margin control, remote on/off and sequencing, faulty channel LED indicator, and signals for out of tolerance, input power failure and current limit.



For more information contact Conver Corp., 10631 Bandley Dr., Cupertino, CA 95014, (408) 255-0151, Robert Lloyd.

CIRCLE INQUIRY NO. 460

COMPONENTS

High-Speed Microprocessor

An ultra high-speed 4-bit bipolar microprocessor offers significant speed-path improvements. The Am2901B is a pin-compatible and plug-in replacement for the Am2901 and Am2901A. Specification improvements in the device's operating speeds were obtained through a 25 percent reduction in the die size.

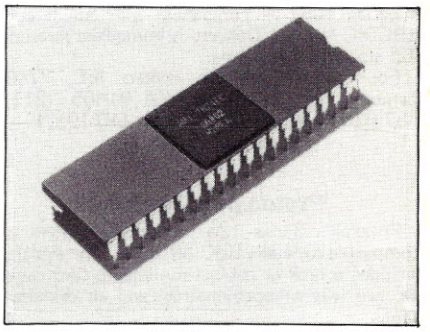
For designs not committed to the 2901 approach, the Am2903 is an upgraded version of the basic bit-slice microprocessor. This circuit eliminates the need for additional hardware for both signed and unsigned multiplication and performs signed division using a non-restoring algorithm.

Both microprocessors undergo 100 percent processing to the requirements of MIL-STD-883. Prices in 100 unit quantities start at $9.95 for the Am2901B and $29.95 for the Am2903. Both parts available nationally from Hamilton/Avnet and Schweber and regionally from Arrow, Bell, Century, Future, Liberty/Elmar, RAE, Sheridan and Summit. For more information contact E. Sopkin, Advanced Micro Devices Inc., (408) 732-2400.

CIRCLE INQUIRY NO. 265

S6802 and S6808 Microprocessors

These new microprocessors further integrate system functions onboard the chip. They are depletion-load N-channel devices available in 40-pin ceramic or plastic packages.



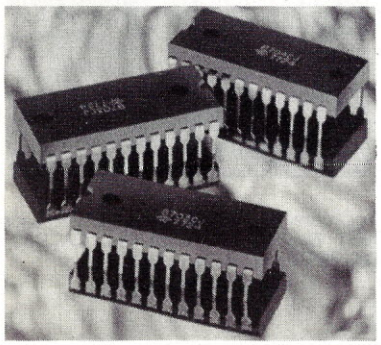
Both chips are object-code compatible with the S6800 and can address up to 64K bytes of memory. Each includes the clock circuitry on-chip, thus eliminating the 6875 clock chip required with earlier 6800 microprocessors. The S6802 also includes 128 bytes of RAM (32 bytes retainable under standby power in power-down situations).

Pricing is $7.80 for S6802 and $6.35 for S6808 in quantity for plastic packages. For more information contact American Microsystems, Inc., 3800 Homestead Rd., Santa Clara, CA 95051, (408) 246-0330, Tom Edel, Mgr. Mktg. Serv.

CIRCLE INQUIRY NO. 266

Three-State A/D Converter

Teledyne Semiconductor has expanded its line of monolithic data conversion products with the addition of 8, 10 and 12 bit A/D converters with three state binary output.



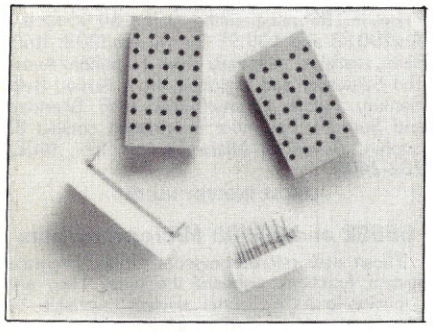
The device utilizes low power CMOS technology and is fully self contained in a single 24-pin DIP requiring only passive support components.

The device is available in plastic or ceramic packages. 100 quantity prices are $8.95 for 8-bit in plastic; $11.50 for 10-bit in plastic; $25 for 12-bit ceramic. Delivery is stock to 4 weeks. For more information contact Teledyne Semiconductor, 1300 Terra Bella Ave., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 267

5x7 A/N LED Display

Industrial Electronic Engineers, Inc. (IEE) now offers a one-inch 5x7 A/N LED display designated at Series LRT1057.



Series 1057 is compatible with ASCII and EBCDIC formats. Delivery is immediate through IEE stocking distributors.

For more information contact IEE, 7740 Lemona Ave., Van Nuys, CA 91405, (213) 787-0311, ext. 268 (Data Sheet LRT1057).

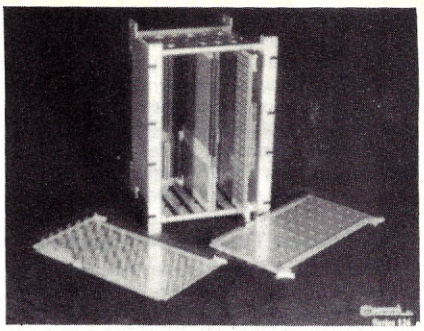
CIRCLE INQUIRY NO. 268

Prototyping System

Prototek's Series 126 prototyping system is compatible to Intel's SBC 80 series. The system includes a rack or cabinet mountable card cage kit, two wire-wrappable cards, and an extender card.

Two versions of Intel SBC 80 compatible board designs are available with universal IC patterns. The voltage, ground, and I/O signal interconnections have three level wire-wrappable pins.

The Series 126 card cage kit introductory price is $185 with prototype cards beginning at $92 and extender cards at $80. Delivery is stock to 2 weeks. For more information contact Prototek,

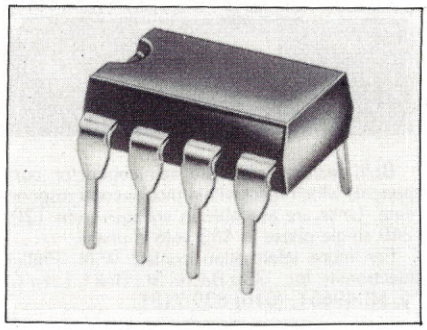


Inc., P.O. Box 46512, Cincinnati, OH 45246, (513) 874-5094.

CIRCLE INQUIRY NO. 269

Bi-Level Voltage Comparator

A bi-level monolithic integrated voltage comparator in a standard 8-pin DIP plastic package is available from Cherry Semiconductor Corporation. The Cherry CS-180 is now being utilized in various applications where a bi-level voltage comparator is required.

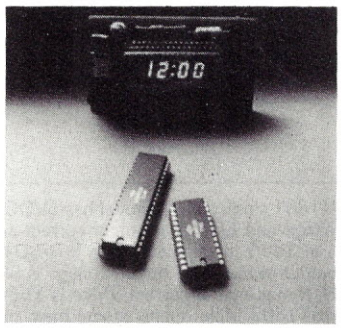


List price for the CS-180 window comparator is $1.75, net cost $.95 in 1,000s and $.76 in 10,000 quantities. For more information contact Cherry Semiconductor Corp., 99 Bald Hill Rd., Cranston, RI 02920, (401) 463-6000.

CIRCLE INQUIRY NO. 270

Auto Clock Circuit Family

OKI Semiconductor has a complete family of monolithic metal-gate CMOS integrated circuits designed specifically for use in digital automobile clocks. All four circuits feature the low power dissipation of CMOS technology.



The MSM5528 circuit interfaces directly with statis 3½-digit vacuum-fluorescent (VF) displays. The MSM5529 circuit drives multiplexed, 4-digit VF displays, and the MSM5929 drives multiplexed, 4-digit LED displays. The MSM5509 is designed to drive 6-digit multiplexed LED automobile clocks.

Price of 100 unit quantities for MSM5528, MSM5529 and MSM5929 is $2.60; the MSM5509 is $3.40. Delivery is from stock. For more information contact OKI Semiconductor, Lawrence Expressway, Santa Clara, CA 95051, (408) 984-4840.

CIRCLE INQUIRY NO. 271

CMOS LSI Decoder/Driver

The MN1205 is a family of CMOS LSI decoder/driver for 2-digit LED numerical displays. All decoder/drivers come in a 22-pin DIP plastic package and operate from a single +5 VDC supply.

The MN1205A can address and drive one of 32 individual LEDs. The MN1205D and MN1205E can drive two digits of a 7-element LED display.

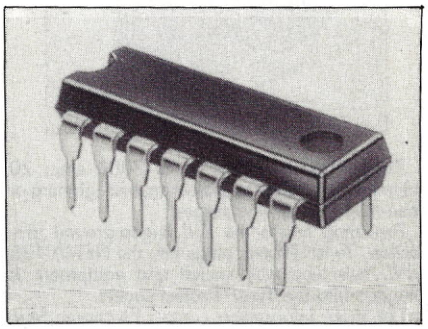
All MN1205 units contain blankin input that can inhibit the outputs. The mask-programmable PLA (programmable logic array) converts the outputs of both latch groups into 14-bit output data. Since the PLA is mask-programmable in accordance with user requirements, MN1205 decoder/drivers can be used in a variety of applications.

Delivery is stock to 8 weeks. OEM discounts available on request. For more information contact Panasonic, One Panasonic Way, Secaucus, NJ 07094, (201) 348-7276, Bill Bottari.

CIRCLE INQUIRY NO. 272

D.C. Motor Speed Control in 14L DIP

The CS-175 is a monolithic integrated circuit D.C. motor speed control housed in a 14L plastic DIP package. The motor speed control is designed to provide maximum flexibility at lowest possible cost.



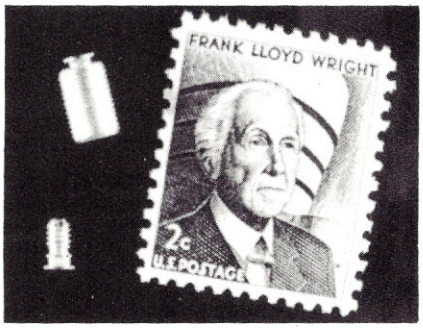
Requirements for adustment and external components in multiple speed applications have been reduced by giving accurate, pin programmable speed ratios for slow, medium or fast motor velocities.

List price for the CS-175 is $1.68; $.79 net cost in 1,000s; $.65 in 10,000 quantities. For more information contact Cherry Semiconductor Corp., 99 Bald Hill Rd., Cranston, RI 02920, (401) 463-6000.

CIRCLE INQUIRY NO. 273

Double Heterojunction LEDs

The first commercially available InGaAsP double heterojunction LEDs for fiber optic communications have been introduced on a limited basis by Varian Associates.



These unique developmental quaternary devices are aimed at second generation optical communications systems. The high radiance geometry allows efficient coupling into presently available commercial fibers. Optical power output of the LED is 0.5 ms minimum with a modulation bandwidth of 50 MHz.

A limited quantity is now available to OEMs who wish to evaluate them for future fiber optic communications systems. For more information contact Varian Associates/LSE Div., 611 Hansen Way, Palo Alto, CA 94303, Attn: J.R. Klein, Mail Stop B-234.

CIRCLE INQUIRY NO. 274

Kable Kraft™ Product Line

CompuCable Corporation Kable Kraft line of high quality, preassembled data communications cables are configured for EIA standard RS-232C applications. The cables are available in standard nine or eighteen foot lengths.

All Kable Kraft products are nine conductor and color coded. Heat shrink tubing surrounds each individual connection for added strength and protection in order to preserve data integrity.

All connectors are standard 25 pin. Kable Kraft cables are also available in custom lengths and configurations upon special request.

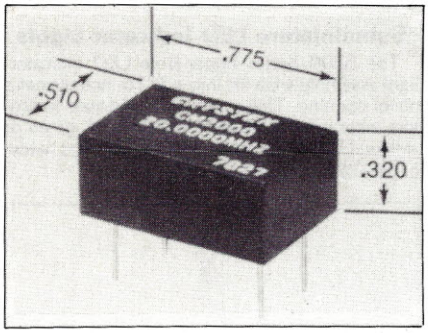
Kable Kraft products are available through local dealers or direct from CompuCable Corporation. For more information contact CompuCable Corp., 2081 Business Center Dr., Suite 180, Irvine, CA 92715, (714) 833-9373.

CIRCLE INQUIRY NO. 275

New Low Cost Oscillators

The CM-2000 series of low cost clock oscillators with greater reliability is available from Crystek Microelectronics.

This new product is a TTL clock oscillator operating in the 500 KHz to 50 MHz range.



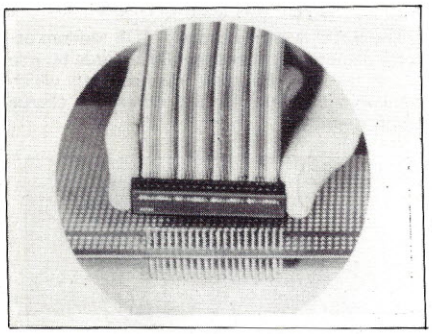
Advantages are due to unique space saving designs and production techniques that utilize high speed rotary printing, active lazer trim, automated inline test systems, and multicavity transfer molding for superior electronic integrity.

For more information contact Crystek Microelectronics, 2659 Nova Dr., Dallas, TX 75229, (214) 427-7072.

CIRCLE INQUIRY NO. 276

Double-Duty Wrap Posts Function As Terminal or Connector

A new wrap post, designated the T46-5-9 functions as a terminal for wrapped-wire interconnections or as pins which mate an inexpensive ribbon-wire connector.



The 0.025 in. square post is 0.24 in. long on the top or connector section, and 0.64 in. long on the bottom. These lengths allow two wire wraps and three wire wraps respectively while the sharp square edges insure gas-tight wraps.

For more information contact Vector Electronic Co., 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 277

High-Efficiency Opto Couplers

Motorola has a series of high-efficiency opto couplers designated 4N35, 4N36 and 4N37. This series of devices offers a 100% transfer ratio.

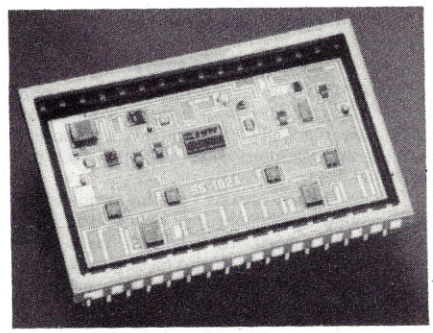
The ability to make these devices is the result of liquid-phase epi technology which yields infrared light emitting diodes with up to 5 times the output of conventional diffused LEDs. This technology uses molten silicon-doped gallium arsenide to form the active P-N junction on a GaAs substrate. The liquid epi is cooled down in accurately controlled steps, resulting in clean crystal growth with a minimum of dislocation.

Price is $1.20 each in 100-up quantities. For more information contact Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 244-6900.

CIRCLE INQUIRY NO. 278

16-Bit A/D Converter in a DIP

The MN5280 costs less than comparable modular units and its convenient 32 pin DIP package requires less than ¼ the space required by a typical 2" x 4" module.



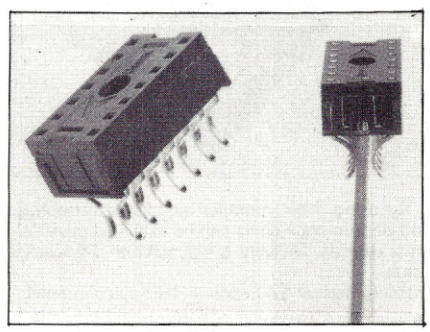
Furthermore, it offers the long term reliability and stability of thin film hybrid construction. The MN5280 features an internal clock, 6 user-selectable input ranges, optional offset and gain adjust points, and short cycling capability. Key specifications include a maximum conversion time of 100 uSec for 16 bits.

Price for 1-24 is $219 each. Quantity discounts available. For more information contact Micro Networks Corp., 324 Clark St., Worcester, MA 01606, (617) 852-5400, John Munn.

CIRCLE INQUIRY NO. 279

Sockets

Scanbe's ME-2 socket is now available in an edge board configuration, offered in 14, 16 and 18-pin sizes. This addition to the ME-2 socket line is useful for edge mounting of LED devices, DIP switches and jumpers where access to edge of board is required for maximum packaging density.



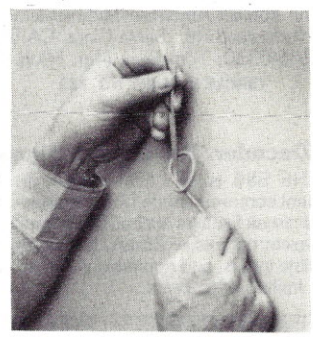
ME-2 sockets are precision molded of UL recognized nylon with tin or gold contacts. These edge board sockets solder easily to edgeboard fingers on .100" centers and provide simple DIP pluggability at edge of circuit board.

Price about $.67 (w/gold) per 16-pin socket in lots of 1K. Delivery is from stock. For more information contact Scanbe Div. of Zero Corp., 3445 Fletcher Ave., El Monte, CA 91731.

CIRCLE INQUIRY NO. 280

Fiberoptic Computer Cable

Valtec Corporation's off-the-shelf DC-PC08-02 fiberoptic computer cable is flexible, crush resistant, and recommended for distances up to a kilometer. This duplex cable is especially designed for both computer and data terminal transmissions.



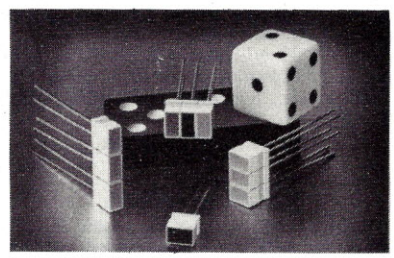
The cable is totally dielectric, immune to induced noise regardless of data rate or length. PC-08 transmits clean data with no greater losses as bandwidth increases.

In large quantities, price is under $2 per meter. For more information contact Valtec Corp., West Boylston, MA 01583.

CIRCLE INQUIRY NO. 281

Rectangular LEDs for Contiguous Mounting

The CM4-64 is a Series of discrete LED indicators in rectangular encapsulations, designed to allow stacking in X or Y direction for contiguous panel displays, bargraph meters, or large alphanumeric displays.



Available in red, yellow or green, CM4-64 Series LEDs offer high brightness with typical luminous intensity of 4.0 mcd at 20 mA for red and yellow, 3.0 mcd at 20 mA for green.

Prices from $.90 for 100 to $.50 per 1,000 depending on color. For more information contact Chicago Miniature Lamp Works, 4433 N. Ravenswood Ave., Chicago, IL 60640, (312) 784-1020, Don Gould.

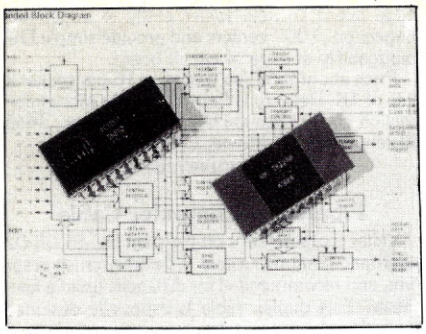
CIRCLE INQUIRY NO. 282

Synchronous Serial Data Adapter

The S6852 Synchronous Serial Data Adapter provides the logic for transmitting and receiving standard synchronous characters of seven to nine bit length.

The interface includes select, enable, read/write and interrupt to allow data transfer using the S6800 or 6500 bidirectional data bus at up to 600K bits/second. Parallel data are transmitted serially with automatic synchronization, fill-character insertion/deletion and error checking.

100 quantity price is $7.65 each in plastic and $9 each in ceramic DIP packages. For more in-

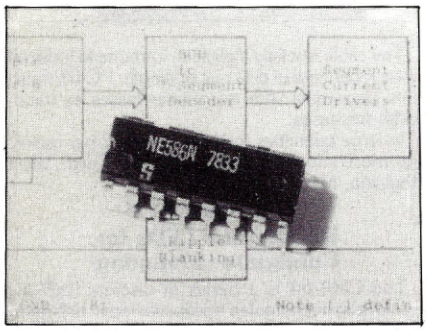


formation contact American Microsystems, inc., 3800 Homestead Rd., Santa Clara, CA 95051, (408) 246-0330, Tom Edel, Mgr. Mktg. Serv.

CIRCLE INQUIRY NO. 283

LED Decoder/Driver from Signetics

The NE 586 is an LED decoder/driver for 7-segment common-anode LED displays. The integrated circuit features latched BCD inputs, constant current outputs of 25mA, low loading bus-compatible inputs, and ripple-blanking on leading and/or trailing edge zeros.



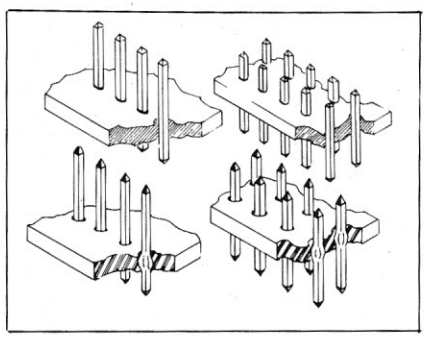
The device is pin compatible with standard 7447, 9374 and 8674 drivers but offers added features. The data (BCD) inputs and LE (latch enable) input are low-loading.

Price in 100 quantities is $1.78 in a plastic package. For information contact Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 284

P.C. Board Posts

Available as loose pieces, in a wide range of lengths, the posts are easily inserted into P.C. boards. After insertion, the posts can be used for wire wrap, solder or connector applications.



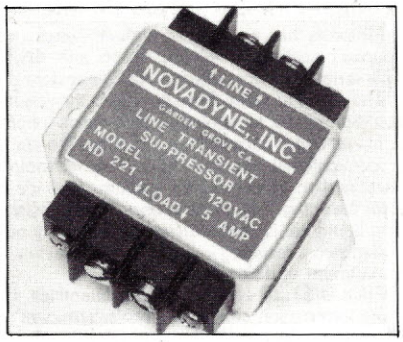
These phosphor bronz posts are gold over nickel plated, making them highly suitable for commercial applications. Bright tin plating is optional. The posts are available in either the straight or shoulder types.

For more information contact Circuit Assembly Corp., 3169 Redhill Ave., Costa Mesa, CA 92626, (714) 540-5490, Richard Foringer.

CIRCLE INQUIRY NO. 285

Line Transient Suppressors

The ND 220 Series of Line Transient Suppressors provide the manufacturer of AC powered equipment a device for extremely fast, wide-band protection from destructive, high-energy surges and transients.



The suppressor combined the best features of a line filter and a transient clipper to supply economical, two-way protection of valuable equipment from line surges and transients.

Prices start at $19.95 for 1-9 quantities. OEM discounts available for larger quantities. Delivery is stock to 10 days. For more information contact Novadyne Inc., 11702 Trask Ave., Garden Grove, CA 92643, (714) 636-4620.

CIRCLE INQUIRY NO. 286

A/D Converter

The ICL7109 is a monolithic A/D converter chip. The ±12-bit device features a three-state output which enables it to be directly interfaced to virtually any microprocessor data bus which is 8 to 16 bits wide.

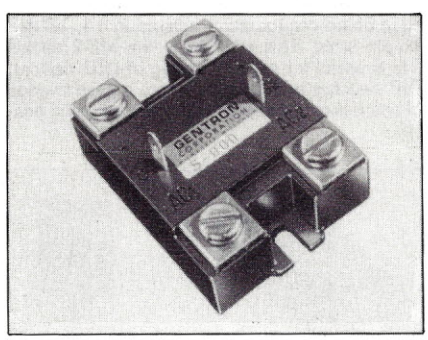
The device may also be used for remote serial data logging applications. For remote data transmission applications, the ICL7109 has a handshake capability so it may also be directly interfaced with universal asynchronous receiver/transmitter UART logic.

Price for 100 quantities is $10 for 40-pin plastic and $19.80 for ceramic dual-in-line packages. For more information contact Intersil, Inc., 10710 N. Tantau Ave., Cupertino, CA 95014, (408) 996-5000.

CIRCLE INQUIRY NO. 287

Hybrid Circuits

The S Series of POWERTHERM® SCR hybrid circuits are available in nine basic circuit types with voltages to 1200 volts and currents to 110 amps. Modules offer significant advantages including a low thermal resistance, isolation and internal interconnects.



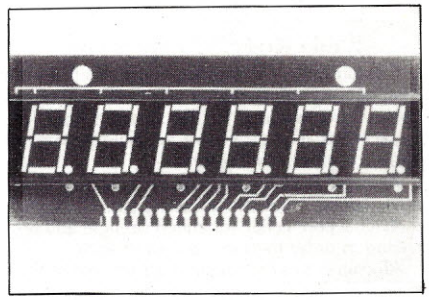
By using these modules significant economic and performance gains can be achieved over discrete devices. Delivery is estimated at 3-4 weeks stock.

Prices start at $20 each in 100 piece quantity. For more information contact Gentron Corp., 6667 N. Sidney Pl., Milwaukee, WI 53209, (414) 351-1660, Lance Kaufman.

CIRCLE INQUIRY NO. 288

Six-Digit, Half-Inch LED Display

The NSB5931 is a six digit, half-inch GaAsP display described as a "form, fit and function" replacement for the DL6500.



Designed for simple multiplex operation, the NSB5931 display has many applications, including data terminals, test equipment, point of sale systems and digital scales.

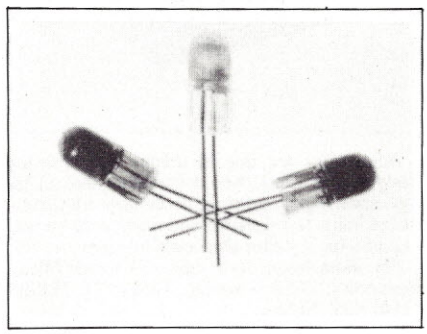
The device is built on a standard printed circuit board to which a plastic reflector and lens cap are attached. The display also features mounting holes and electrical connection is accomplished by means of terminals on the edge of the board.

Price is $10.80 in 25 lots. Delivery is one week. For more information contact National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 289

Subminiature LED Indicator Lights

The 5200 Series Super-Brite LED indicator-light assembly snap-fits into a 3/16-inch diameter panel opening. These compact solid-state indicators incorporate ultra-high intensity red, green or yellow LEDs in a housing that provides wide-angle (180 degree) viewing.

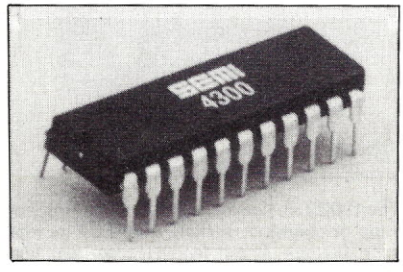


Conservatively rated and low in cost, these rugged, long-lived units usually outlast the product in which they are installed. Price is $.40 each in 1,000 quantities. For more information contact Industrial Devices, Inc., Edgewater, NJ 07020, (201) 224-4700.

CIRCLE INQUIRY NO. 290

4300 4K Static RAM

The 4300 is an N-channel, MOS random access memory organized as 4096 words by one bit. It uses a fully static memory cell which eliminates the need for any refresh or charge pump circuitry.



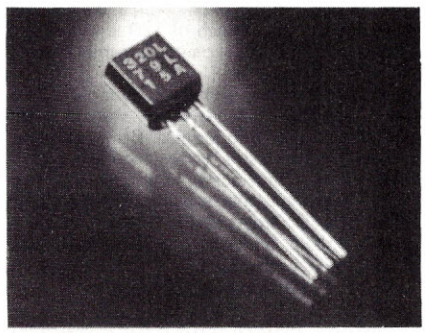
All inputs can be driven by standard TTL devices and the three state data output can directly drive on TTL load of any type.

The 4300 is priced at $4.50 in quantities of 10,000. For more information contact EMM Semi, Inc., 3883 N. 28th Ave., Phoenix, AZ 85017, (602) 263-0202, F.L. Krch, Dir. Mktg.

CIRCLE INQUIRY NO. 291

Negative Voltage Regulators

Two new series of fixed output, three terminal negative voltage regulators feature significantly improved system performance and lower cost.



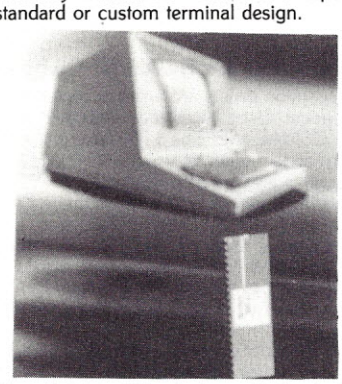
Designated the LM320L and LM320ML, the devices feature ripple rejection specifications that are 15dB better than present devices, plus quiescent current change with line specifications is six times lower and line regulation that is three times better.

For more information contact National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 292

I±L CRT Controller

By combining linear, integrated injection logic (I^2L) and low-power Schottky processes on a single integrated circuit, National Semiconductor has developed a cathode ray tube controller that significantly reduces the number of components in standard or custom terminal design.



The bipolar LSI device, designated the DP8350, combines an oscillator, complete timing, CRT refresh, logic, and video control circuits into a single 40-pin package.

Price is $49 each in 1-24 lots. For more information contact National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 293

32K EPROM

The 2732 EPROM is a 32, 768-bit ultraviolet erasable and electrically programmable read-only memory which is pin compatible with the 2716 EPROM, allowing storage densities to be upgraded without system design changes.

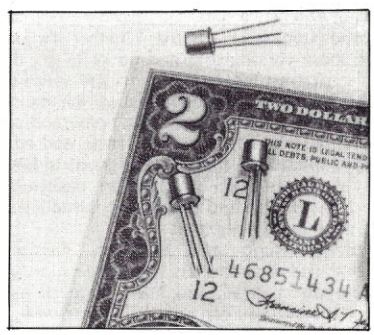
With this compatibility and flexibility in design, a system designer can upgrade system performance without disturbing board layout.

Price is $147.30 for single units; $106.80 each in 25 unit quantities; and $91.65 each for 100s. For more information contact Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051, (408) 249-8027, Rob Walker.

CIRCLE INQUIRY NO. 294

Miniature 6A Rectifiers

The HSR-2-52 Series of miniature 6 ampere ion-implanted rectifiers block up to 100V and have a recovery time over two times faster than conventional devices: 15 nanoseconds typical reverse-recovery time with a maximum recovery time of 20 nsec.



There are seven devices in the HSR-2-52 series with maximum peak-repetitive reverse voltages from 20V to 100V; maximum root-mean-square voltages are 15V to 70V.

Prices are from $1.90 to $4.25 each in 100 to 999 quantities. Delivery is 4 weeks ARO. For more information contact Solid State Devices, Inc., 14830 Valley View Ave., La Mirada, CA 90638, (213) 921-9660.

CIRCLE INQUIRY NO. 295

LITERATURE

Kennedy Company Offers Disk Drive Brochure

A new six-page, four-color brochure describes the new Kennedy Series 5300 Winchester fixed disk drive. The drive, with one, three or five recording surfaces, has an unformatted storage capacity of 14M bytes, 42M bytes and 70M bytes, respectively.

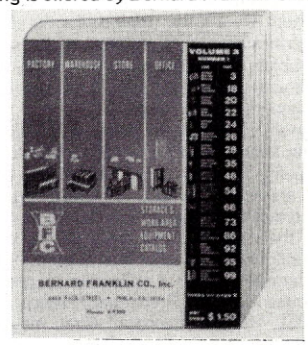
Using the modified-frequency modulation techniques with 3348-type media, the Series 5300 has a recording density of 6000 bits per inch with a track density of 300 tracks per inch. Recoverable read error rate is 1 in 10^{10} bits transferred. Data transfer rates are 8M bits per second. Single track seek time is 10 msec and average seek time of 45 msec.

Kennedy Company markets and manufactures magnetic tape transports, disk drives, and cartridge recorders to OEMs throughout the world. For more information contact Kennedy Co., 540 W. Woodbury Rd., Altadena, CA 91001, (213) 798-0953.

CIRCLE INQUIRY NO. 296

Storage Systems Guide Useful for Storage Planning

A new, handy 48-page "Buyers Guide to Storage and Work Area Equipment Systems, Volume 3, No. 1" for executives responsible for storage planning is offered by Bernard Franklin Company.



Especially helpful for new facilities or additions to existing storage areas, this convenient, fact-filled book is crammed with ideas on how to layout storage areas. It shows types of storage equipment to use, with hundreds of illustrations of space saving ideas. Shown are various types of shelving, pallet racking, storage-retrieval and mezzanine systems, lockers, gondolas, benching and shop equipment.

It is a must for companies who are expanding or need more space. A real professional aid. For your free copy, write Bernard Franklin Co., 4424 Paul St., Philadelphia, PA 19124.

CIRCLE INQUIRY NO. 297

Data Acquisition

A new 6-page brochure on the 7253A Data Acquisition system and a 6-page DAS flow chart specification guide has been announced by FI Electronics.

The flow chart is a very useful tool and could be used in specifying a data acquisition system.

The DAS features high speed (800 readings/sec) sampling of low level signals like thermocouples with 5½ digit (±17 bits) resolution.

A price list if also included with the data package. For more information contact FI Electronics, 968 Piner Rd., Santa Rosa, CA 95401, (707) 527-0410, Edward Bollet.

CIRCLE INQUIRY NO. 298

Auerbach Business Minicomputer Systems Reports Now Contain Graphics Display Terminal Coverage

A new section, designed to provide comprehensive coverage of the graphics display terminal market, has been added to the Auerbach Business Minicomputer Systems Reports.

Contained in the two-volume loose-leaf service, the graphics display terminal reports include complete information on this fast-growing market. Represented are such manufacturers as Tektronix, Imlac, Magnovox Display Systems, Sanders Associates, Megatek, Hewlett-Packard and Ramtek.

As well as the new graphics display terminal coverage, additional reports on terminals contain the latest data on teleprinters, alphanumeric displays, remote batch terminals, and intelligent terminals. More than 450 models of terminals from over 130 different manufacturers are included in these sections.

The Auerbach Business Minicomputer Systems Reports is a monthly updated reference covering the latest information on business minicomputer equipment.

For more information on contact Auerbach Publishers Inc., 6560 N. Park Dr., Pennsauken, NJ 08109, (609) 662-2070.

CIRCLE INQUIRY NO. 299

Motorola Unveils Macrocell Array Design Library

Motorola has completed a Preliminary Design Manual for its Macrocell Array concept which

provides a faster and less expensive approach to VLSI digital system designs. The manual defines an initial macrocell library of 85 fully-characterized circuit functions.

Combined with a high-density diffusion process and a unique method of customer-vendor interface, the extensive library of computer-stored macrocells offers a new method for the design of high performance (ECL) digital systems. It is a way to obtain VLSI designs more quickly and at a considerably lower cost than the more conventional gate-array approach.

Motorola's Macrocell Array frees designers from the tedious chore of dealing with the gates individually. In this array, the basic building blocks are more complex standard logic functions, so that the designer need be concerned only with the connection of these functions in the right configurations, rather than creating the functions themselves from a collection of gates.

The new Motorola Preliminary Design Manual for MECL 10,000 Macrocell Array may be obtained by writing to Motorola Semiconductor Products, Attn: MECL 10K Macrocell Array Mktg.-M142, P.O. Box 20912, Phoeniz, AZ 85036.

CIRCLE INQUIRY NO. 300

Computer Memory Products and Quality Control

A 9x12 inch, full-color brochure detailing the rigorous production procedures and describing many of the disk packs, cartridges, and diskettes manufactured by Nashua Corporation is now available. Product descriptions are enclosed on separate illustrated sheets providing full specifications.

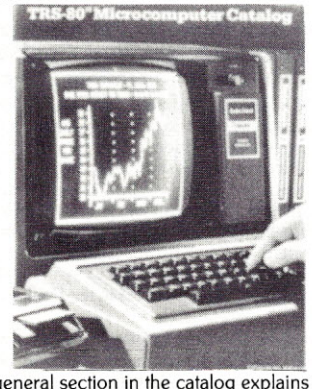
Two booklets, one providing complete listings of compatibility between disk drives and Nashua products, another providing suggestions and guidelines for the maintenance and handling of magnetic disks, are also available without charge from Nashua Corp., Nashua, NH 03061

CIRCLE INQUIRY NO. 301

TRS-80 Microcomputer Catalog

A 20-page, full-color TRS-80 Microcomputer Catalog is available from Radio Shack.

The catalog includes complete, current information on the TRS-80 Microcomputer, its peripherals and accessories with plain-language descriptions, application ideas and detailed specifications.



A general section in the catalog explains what a computer is, what it can do, "Who can use the TRS-80," and "Why the TRS-80?".

TRS-80 Microcomputer Catalog #RSC-2 is available free, on request, from Radio Shack stores and dealers nationwide. For more information contact Radio Shack, 1400 One Tandy Ctr., Fort Worth, TX 76102.

CIRCLE INQUIRY NO. 302

Conference Analyzer 78

The many conferences held each year often make it difficult for the businessman to decide which, if any, to attend. Management Information Corporation is offering a solution to this problem — the Conference Analyzer 78. This package contains complete evaluations of seven conferences, reflecting trends and attitudes in both word and data processing.

The seven conferences covered are:

- Personal Computing and Small Business Computer Show in Philadelphia
- Interface 78 in Las Vegas
- DataComm 78 in Washington, D.C.
- Mini/Micro Computer Conference in Philadelphia
- Internatinal Word Processing Association Syntopican VI in Wasington, D.C.
- OCR Users Association Conference in Hershey
- Second Annual Data Entry Management Conference in San Diego

Each evaluation discusses the exhibits in terms of their quality and quantity, as well as describing and analyzing key seminars. Also included are the results of a survey taken by MIC, questionning both the vendors and attendees on their opinions of the conference.

The Conference Analyzer 78 is available for $25. (Outside the U.S. and Canada, $35. U.S. dollars only) NJ residents add 5% sales tax. To obtain a set, send a check or money order, payable to Management Information Corp., 140 Barclay Ctr., Cherry Hill, NJ 08034.

CIRCLE INQUIRY NO. 303

Programs for TRS-80

32 BASIC Programs for the Radio Shack TRS-80 by Thomas Rugg and Phillip Feldman is a paperback published by dilithium Press.

This book is the companion volumn to dilithium's software tape cassette series for the TRS-80. An excellent way for the TRS-80 owner to get up and running in a hurry. Whether it's just to plug these cartridges in and go or to get down and customize the programs to suit specific requirements, this is the book that will tell you how. From practical uses around the home and office to computer graphics, games, math and educational applications, these 32 programs in BASIC will allow the TRS-80 user an easily-understandable, flexible and entertaining introduction to microcomputer operations.

Authors Rugg and Feldman, themselves experienced programmers, explain each program application in detail, and make suggestions for programs that you can write on your own by using the suggested reference materials.

The accompanying program tapes containing the 32 programs detailed in the book are available on 5 separate tapes from dilithium Press for $9.95 each. The book is $15.95. For more information contact dilithium Press, 30 NW 23rd Pl., Portland, OR 97210, Attn: Ed Uecker, Mktg. Dir.

CIRCLE INQUIRY NO. 305

Monthly Review of New Software Products Available

Users of North Star BASIC can receive a free subscription to John Dvorak's Software Review.

Each month John examines and reviews new software packages and reports to his readers on the relative merits and value of the product. Many older and overlooked products are also seen in the pages of the newsletter.

For a free subscription write to J. Dvorak, 704 Solano Ave., Albany, CA 94706. State your computer system configuration.

CIRCLE INQUIRY NO. 306

Pertec Tape Transport Subsystem Report

Pertec Computer Corporation's FT6250 tape transport subsystem is highlighted in a specification sheet available from PCC's Pertec Division.

Featuring 6250 bit-per-inch (BPI), Group Code Recording (GCR), the FT6250 consists of the T1940 tape transport and F6150 formatter.

The T1940 allows the user to record four times more data on a reel of tape than conventional 1600 bpi tape drives, moving at speeds of up to 125 inches per second. It also offers complete self-diagnostics, error correction and checking and logging techniques, reducing service time and eliminating expensive on-site test equipment.

The data sheet also provides photos and a complete list of specifications for both products including tape speed, optimal operating and non-operating temperatures and relative humidity, mechanical, electrical and physical descriptions and compatible media.

For further information or a copy of the specification sheet, contact Pertec Computer Corp., Pertec Div., MS40/04, 9600 Irondale, Chatsworth, CA 91311, (213) 999-2020, ext. 303.

CIRCLE INQUIRY NO. 307

Computer Terminals Directory

A user-oriented directory of computer terminals is published by the Association of Time-Sharing Users (ATSU). With a photograph and a full page of information about each of 120 terminals, the Directory represents over a year's compilation effort by the Association.

In bound form, the *Computer Terminals Directory* is available from the Association of Time-Sharing Users for $45 prepaid. By subscription, in loose-leaf form, it is part of the Association's three-volume "Interactive Computing Directories," and is available as part of membership in ATSU for $85. Orders for the Directory or membership should be sent to ATSU, P.O. Box 9003, Boulder, CO 80301.

CIRCLE INQUIRY NO. 308

Computer Programming for Engineers

Modern design and civil engineers face the certainty of working with computers, either in direct programming, or defining program specifications and computing needs, or as program users.

Computer Aided Structural Design by D. Clarke demonstrates in detail the ways in which a variety of common structural design problems can be defined in computing terms and translated into BASIC computer language.

The book builds specific computer programs around familiar design situations taken from the fields of reinforced concrete, prestressed concrete, and structural steelwork. Written for the engineer, the book reduces computer jargon to a minimum, and stresses engineering aspects of the problems.

Price is $25.50. For more information contact John Wiley & Sons Inc., 605 Third Ave., New York, NY 10016.

CIRCLE INQUIRY NO. 309

Newsletter for RCA VIP Owners

Subscription orders are being accepted for the independent User Newsletter dedicated to the RCA COSMAC VIP. The $15 subscription price includes all ten issues of Volume 1 — and issues 1 through 3 are currently available.

The VIPER will include items of interest solely to owners of the VIP, and the first three issues contain articles revealing the machine language code for CHIP-8, the VIP's user language; an annotated listing of the operating system, and the first in a series of articles describing a text editor for the VIP.

Send subscription orders, articles, letters, software (for review, exchange or sale) to THE VIPER, P.O. Box 43, Audubon, PA 19407. BAC/Visa/MC/check/money orders accepted. No C.O.D. or billing. Overseas orders include $10 for airmail postage if desired.

CIRCLE INQUIRY NO. 310

Reference Book for Teachers

Teachers' Desk Reference, a versatile "idea Book" for all educators, presents dozens of fresh teaching strategies and approaches to be incorporated into teaching programs at all levels. Tried-and-true methods are included along with newer, experimental ones.

The book contains a series of teaching methods, arranged in alphabetical order. They range from audiotape through lectures and maps to videotape recording and workshops. The outlines list purposes, advantages, and disadvantages of each method and give suggestions for their use.

Author Marilyne B. Gustafson, R.N., M.S.,

also holds a bachelor of science degree in nursing education. Sheila Corcoran, R.N., M.Ed., has been as associate professor in the University of Minnesota School of Nursing since 1974. Both women are authors of numerous publications in the field of education.

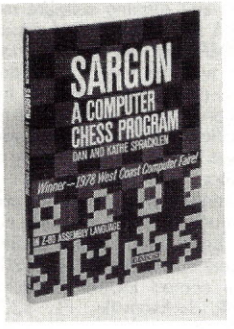
Price is $9.50. Orders and payment should be sent to Medical Economics Book Div. (DPRK8), Box 554, Oradell, NJ 07649.

CIRCLE INQUIRY NO. 311

Computer Chess Program

SARGON: A Computer Chess Program is available from Hayden Book Company in both a book and a computer tape.

The user can play black or white, and can select the depth of look-ahead from one to 6 ply.



Moves are entered in algebraic chess notation. The book offers complete and unambiguous documentation covering algorithms. It contains a block diagram of the program, a Z-80 assembly language listing of the program and an index to the subroutines.

The Tape, #00603, $19.95; The Book, #5155-7, $14.95. To order either or both write to Hayden Book Co., Inc., 50 Essex St., Rochelle Park, NJ 07662.

CIRCLE INQUIRY NO. 312

Accounting Computerization Guide Revised to New EDP Technology

Financial managers will be able to take fuller advantage of the latest state-of-the-art advances in computerized accounting systems with a newly-revised and updated second edition of *Computerized Accounting Methods and Controls,* by Michael R. Tyran.

This guide shows how to get better, more timely accounting information at lower cost, through the incorporation of such recent technological breakthroughs as data integration, the use of data banks, the establishment of online terminals for data input and retrieval, and data storage on microfiche film.

This practical guide takes the "mystery" out of computer jargon, and puts it into easy-to-understand, accountant-oriented language. It features tested procedures for using automated statistical techniques, full details on a computerized property system, techniques for implementing a computerized sales backlog system, model input and output formats, together with numerous diagrams depicting mechanical system programming.

Price is $27.95. For more information contact Prentice-Hall, Inc., Englewood Cliffs, NJ 07632.

CIRCLE INQUIRY NO. 313

Guide to TRS-80 Information

The Guide to TRS-80 Information (Second Edition) is a very special handbook for business persons, hobbyists, computer journalists, programmers, scientists and engineers, and teachers — anyone interested in microcomputer systems.

The *Guide* permanentizes in one place a large number of exciting references to or about Radio Shack's TRS-80 microcomputer, and the broad field of hard/software designed for it. You could not otherwise find all this information about the TRS-80 unless you searched extensively for days or weeks through many thousands of pages of literature.

Price is $2.80 plus $.50 for postage and handling. Quantity prices available. To order or for more information contact F.E. Huebner, Dept. B, P.O. Box 37206, Oak Park, MI 48237.

CIRCLE INQUIRY NO. 314

TRS-80 Journal

The 80-Northwest Journal is a publication devoted entirely to the TRS-80 microcomputer. The Journal features complete BASIC and Machine Language program listings. It covers the entire spectrum of TRS-80 capability, including programs and articles on Business, Audio-Visual, Scientific and Games. Currently it is running a series on Machine Languae programming for beginners. Hardware features and product reviews are also included.

Subscription price is $16 peryear. The *80-Northwest Journal* is published bi-monthly by 80-Northwest Publishing, P.O. Box 7112 Tacoma, WA 98407.

CIRCLE INQUIRY NO. 315

Computerizing Your Business

From the Counter to the Bottom Line is a paperback book by Carl Warren and Merl K. Miller.

With computer technology becoming ever more accessible and understandable to the "man on the street," microcomputers are opening up a whole new world of simple low-cost business support opportunities for the small and medium-size business.

While the "personal computer" concept is still thought to many to be strictly an area of interest to the home hobbyist, our authors Warren and Miller show in detail the kinds of possibilities for accounting applications that can be realized with the inexpensive home computer.

This is a book for businesses that are ready to take the plunge. Beginning with the "how to" of switching from a manual to a computerized accounting setup, the authors describe each of the subsystems and outline application procedures for areas including inventory control, purchasing, accounts payable and receivable, general ledger and billing.

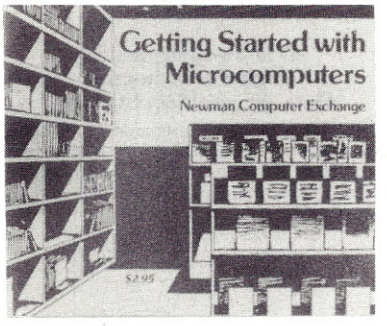
In a world of ever increasing volumes of paper work to be sorted, noted, coded and filed, the microcomputer can become a real boon to small businessmen everywhere and this book shows them the way and the how of it all.

Price is $12.95. For more information contact dilithium Press, 30 N.W. 23rd Pl., Portland, OR 97210, Ed Uecker, Marketing Director.

CIRCLE INQUIRY NO. 304

Free Guide to Home Computers

A helpful book on the latest and best information about home computers is free to readers of (magazine) NCE/CompuMart, Inc.



Getting Started with Microcomputers evaluates 25 books and periodicals on current technology and equipment and recommends each for its usefulness to the programmer, engineer or systems designer. This illustrated paperback also includes an up-to-date buyer's guide with current prices and capabilities of today's home computers.

For a free copy write to NCE/CompuMart, Inc., P.O. Box 8610, Ann Arbor, MI 48107.

CIRCLE INQUIRY NO. 317

Guide to 1979 Buyers

If anyone in the EDP industry needs proof that 1979 will be a banner year for minimicrocomputer suppliers, they need only to thumb through Datamation magazine's 1979 Mini/Microcomputer User File.

System houses, OEM companies, and end-users will be on a buying binge; over 5500 of these sites have detailed their 1978 and 1979 purchases and buying intentions for specific mini/micro computer products by name — the total exceeds $790 million.

Coverage includes vendor preferences as well as on-order and installed hardware, software and applications.

Datamation magazine's Mini/Microcomputer User File is available to sales and marketing executives. Prices vary according to the type of file service desired and options selected. For more information contact Dorothy Chamberlin, (203) 661-0055.

CIRCLE INQUIRY NO. 318

Socket-Pin Panel and Card Catalog

A 24-page catalog No. 193 features EECO's extensive product line of wire wrap socket pin panels, cards and mounting hardware. Prices are included in catalog.

Accompanying illustrations and photographs are technical specifications, dimensions and part number matrices. A convenient information request page is also included.

For a copy or more information contact EECO, 1441 E. Chestnut Ave., Santa Ana, CA 92701, (714) 935-6000, Electronic Packaging Mrktg.

CIRCLE INQUIRY NO. 319

ADCAP Dropline to Ring Conversion Data Sheet

Intelligent Terminals, Inc. has available an illustrated data sheet describing their ADCAP equipment's application for cost-effective rapid conversion of a multi-dropline network to a ring network with the added capability of packet switching.

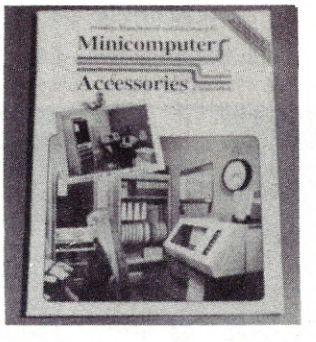
The literature describes the use of ADCAP, a multi-microprocessor-based network building block, to provide low-cost, flexible, high efficiency solutions to the limitations of multi-drop networks such as low reliability, cost redundancy without compensating system redundancy, inefficiently used capability, restriction to a single discipline, and restricted operating speed.

The free data sheet is available from Intelligent Terminals, Inc., One First St., Los Altos, CA 94022, (415) 941-6892.

CIRCLE INQUIRY NO. 321

64-Page Catalog from Minicomputer

Minicomputer Accessories Corporation, a distributor and manufacturer of supplies and accessories for the minicomputer user, has available their new, free Winter '79 catalog.



Thid catalog, packed with over 800 products, offers everything from field-proven media, line-printer ribbons, printwheels, computer paper, binders and programmers' aids to media-storage cabinets specifically designed for data security and protection.

For a free copy contact Minicomputer Accessories Corp., Dept. P-10, 130 S. Wolfe Rd., Sunnyvale, CA 94086, (408) 737-8700.

CIRCLE INQUIRY NO. 322

Resource Handbook

Beginning in April, microcomputer users and prospective purchasers in the New England area will have a complete directory available for locating products and services, *The First New England Microcomputer Resource Handbook*. Designed as a directory fo every resource available in New England, *The Handbook* will list and describe computers, peripherals, software, retailers, repair organizations, courses, clubs, user groups, user publications, and trade journals.

The Handbook is another resource of The Boston Computer Society, Boston's information exchange and resource center for the microcomputer industry.

The Handbook will be approximately 75 pages and will sell for $2 at participating computer stores or by mail from: The Boston Computer Society, 17 Chestnut St., Boston, MA 02108.

CIRCLE INQUIRY NO. 323

PET Workbook

A new workbook on PET Control and Logic is available. This well-written, easy-to-read document covers testing and branching, subroutine use, and logical oeprations. Binary to decimal and decimal to binary conversion programs are used to demonstrate the logical operations.

Another new product from Total Information Services is a mailing list program available as a source listing and on cassette. This program allows you to select and display mailing list entries. These entries are stored on cassette and can be printed on your hardcopy device.

All TIS documents, which include many exercises and sample programs, have been carefully tested and edited by professional programmers and writers. Write today for a free copy of our retail flyer. Send SASE to TIS, P.O. Box 921, Los Alamos, NM 97544.

CIRCLE INQUIRY NO. 324

Everything You Ever Wanted to Know About Floppy Disks

Square One Company, a distributor and manufacturer of floppy disks and supplies has just released a 12-page booklet explaining everything you should know about floppy disks before you either buy them or use them. Entitled "The Floppy Disk, What You Should Know," details the care and handling of the media, how to properly mail floppies and how they work.

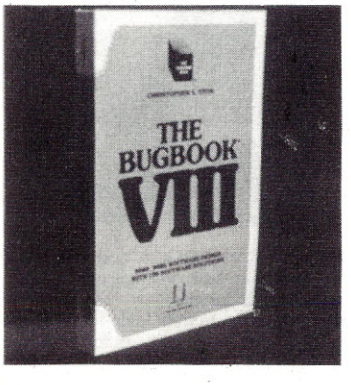
The booklet is useful for new personnel in office and word processing environments. It helps newcomers feel more comfortable by providing them with knowledge and saves them from the possible embarrassment of ruining a diskette or losing data.

For a free copy contact Square One, 614 18th Ave., Menlo Park, CA 94025.

CIRCLE INQUIRY NO. 325

New Bugbook from E&L

Bugbook VIII, 8080/8085 Software Design with 190 Software Solutions is a detailed treatment of assembly language programming for 8080 and 8085 based computers.



E&L Instruments has added this soft cover text to the Bugbook Series, written by Dr. Christopher A. Titus and edited by D. Larsen, P. Rony , and J. Titus and C. Titus. 288 pages of elementary and advanced instructions which are analyzed and discussed.

Price is $9. For information contact E&L Instruments, Inc., 61 First St., Derby, CT 06418, or its sales representatives.

CIRCLE INQUIRY NO. 326

New Reference Books from O&A

An Introduction to Microcomputers: Volume 2 — Some Real Microprocessors replaces the 1977 edition of Osborne & Associates' Volume 2: Some Real Products. The new version is 1400 pages, representing a significant expansion of the previous edition. Some Real Microprocessors covers every major microprocessor on the market — 4-bit, 8-bit and 16-bit.

An Introduction to Microcomputers: Volume 3 — Some Real Support Devices is a reference book offering extensive descriptions on microcomputer support devices which can be used with more than one microprocessor. Among the categories discussed in Volume 3 are memory devices, parallel and serial I/O devices, CPU single-function and multi-function support devices, and system busses.

Price for Volume 2 is $30 ($25 without binder) and is illustrated with 392 figures and 110 tables. Volume 3 is $20 ($15 without binder) and contains approximately 700 pages with 212 figures and 122 tables.

For more information contact Osborne & Associates, Dept. X2, 630 Bancroft Way, Berkeley, CA 94710.

CIRCLE INQUIRY NO. 327

New Robot Catalog

The 1979 Grivet Series Catalog contains detailed drawings and 100 pages of design data in a 3-ring binder. Inside you will find all the interchangeable parts and standard materials you will need to construct over 1,000 different configurations. Build a simple little two-foot motorized box, or a multi-legged insect-like creature, or accept the challenge of a seven-foot, two-legged, dual-armed android.

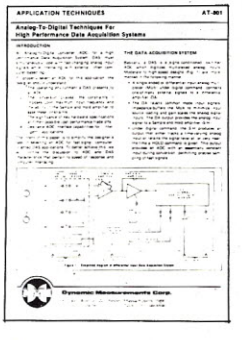
Interface a robot to a microprocessor through our DC motor controller and positional feedback boards. Use your own plans, or select from any of ours. Put a robot together and then take it apart and build a completely different one from the same parts, and buy more parts and expand your system.

Price is $10. To order or for more information contact Gallaher Research, Inc., P.O. Box 10767, Winston-Salem, NC 27108.

CIRCLE INQUIRY NO. 328

A/D Techniques for High Performance Data Acquisition Systems

This four page paper, prepared by the applications engineering staff of Dynamic Measurements Corporation, analyzes ADC and DAS characteristics that pertain to speed of response and computer interfacing.


APPLICATION TECHNIQUES AT-801

Analog-To-Digital Techniques For High Performance Data Acquisition Systems

INTRODUCTION

THE DATA ACQUISITION SYSTEM

An analog-to-digital converter for a high performance data acquisition system must simultaneously cope with fast-changing analog input signals while interfacing with external, often computer-based logic.

Applications Techniques number AT-801 is available upon request from Dynamic Measurements Corp., 6 Lowell Ave., Winchester, MA 01890.

CIRCLE INQUIRY NO. 329

TRS-80 Software Publication

DUMP Publications Division of Micro Systems Services, Inc. has a software publication for users of the Radio Shack TRS-80 microcomputer system. DUMP, devoted entirely to the TRS-80 user, is a monthly periodical incorporating news, information and running software ready to load from a 33⅓ RPM DUMP Disk record.

The DUMP Disk can be loaded into the TRS-80 system with the use of an ordinary phonograph. This new software medium has been developed to provide the user with the most permanent and efficient method of program storage.

Each issue contains a wide variety of programs from finance and education to games and machine language. Programs are provided with complete documentation and line editing information for Level I and Level II BASICs.

A one year subscription costs $20. For more information contact DUMP Publications, P.O. Box 2454, Jacksonville, FL 32203, (800) 874-4500.

CIRCLE INQUIRY NO. 330

Free Brochure Describes Traficus™

A 12-page free brochure from Digital Telephone Systems, Inc. desribes some of the most advanced computerized telephone traffic data systems available.

Included in the brochure are photographs, diagrams and descriptions of the Traficus line of systems which are manufactured by Applied Computing Devices and marketed by Digital Telephone. Three system configurations are detailed, from the most basic to the most complex multi-site scanner/processor system.

Also described are product support plans, sample reports, factory program packages, and descriptions of the products, including pollers/processors, circuit analysis processors and pollers/converters.

For a copy contact Digital Telephone Systems, Inc., Literature Distribution, 1 Commerce Blvd., Novato, CA 94947, (415) 472-2500.

CIRCLE INQUIRY NO. 331

Brochure on Personal Computer Components

National Semiconductor Corporation has a 24-page brochure available on its broad range of components to serve the personal computer industry.

The glossy-paged booklet is a guide to more than 100 components including microprocessors, memories, CRT controllers, LED displays, floppy disk interfaces, serial and parallel interfaces, sound synthesizers, analog interfaces, and printer interfaces.

The brochure also discusses National's support for personal computer manufacturers.

For a free copy contact National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5897, Wade Miracle MS/770.

CIRCLE INQUIRY NO. 332

Test Instruments Catalog

The entire line of B&K-Precision test instruments as featured in the BK-79 big catalog has been condensed into a compact catalog, suitable for inclusion in a 6¾ size envelope. The new BK-9 allows distributors to take advantage of postage economies in mailing a smaller sized catalog. It is also ideal for use as a package "stuffer" in customer orders.

The catalog measures 3½" x 6" and consists of 52 pages, with an index and space for the distributor to imprint on the back cover. Mailing weight is equivalent to a standard size 8-page catalog. Copies are available in quantity, without charge, to B&K-Precision Distributors, by writing directly to Marketing Manager, B&K-Precision, Dynascan Corp., 6460 W. Cortland St., Chicago, IL 60635.

CIRCLE INQUIRY NO. 333

SOFTWARE

ASI Software Now CP/M Compatible

Administrative Systems, Inc., has available its single user system software OPUS/ONE, OPUS/TWO, S.O.S., and FORTE, on CP/M-compatible diskettes. This new format will allow users with a 32K (minimum) CP/M-based system to load and execute immediately A.S.I.'s powerful system software packages.

Each package is structured as a CP/M-compatible file which, when loaded, will execute using the device drivers already existing under CP/M. Other files include a System Generation Routine, which will allow the user to create an A.S.I. standard system diskette with customized device drivers, and a FORMAT routine, used to set up data diskettes.

These packages are available at standard cost and include user's manuals. Manuals may also be purchased separately, and their cost credited toward the cost of the appropriate software. The software is supplied on soft-sectored IBM-3740 (8-inch) compatible diskettes, single density.

For more information contact Administrative Systems, Inc., 1642 S. Parker Rd., Suite 300, Denver, CO 80231, (303) 755-9694.

CIRCLE INQUIRY NO. 334

Source Listings Available for Disk BASIC Etc Interpreter

Binary Systems Corporation offers a complete source listing of Disk BASIC Etc, a BASIC language interpreter.

Purchasers of Disk BASIC Etc also receive a 48-page language manual and a 50-page instruction manual for modifying or adding routines.

As written, disk operation is sector based using the iCOM Company model 3712 flexible disk drive device.

The 6000-line source listing assembled into 12,000 bytes of 800 code.

Price for source listing and two manuals is $100. These may be purchased from the Micro Store, 634 S. Central Expwy., Richardson, TX 75080.

CIRCLE INQUIRY NO. 335

OASIS Operating System

Phase One Systems, Inc. is marketing distributor and single CPU licenses for the OASIS high performance operating system. Users and manufacturers of Z-80 and 8080 based microcomputers can realize significant dividends in performance and throughput with OASIS by optimized disk I/O and many other high performance enhancements.

Outstanding features are keyed index files (ISAM), communications package, hard disk drivers, multi-user option, versatile text editor, FORTRAN, COBOL, and BASIC languages, print spooler, job control languae, macro relocating assembler, dynamic debugger, and many other utilities and features.

An extensive business system package software is also available. For brochure or other information contact Phase One Systems, Inc., 7700 Edgewater Dr. #710, Oakland, CA 94621, (415) 562-8085.

CIRCLE INQUIRY NO. 336

PDS

The PDS assembly language development system is now fully operational under CP/M. PDS includes a relocating macro assembler, linkage editor/linking loader, string oriented text editor, interactive editor/assembler, and trace debug/monitor programs. PDS features full Z-80 capability while remaining fully operational on any 8080 machine.

The relocating macro assembler and linkage editor support modular program development: large programs can be developed in independent, easily manageable segments which can be linked together for execution. Program segments can be chained together at the source level or linked together at object level.

The interactive editor/assembler allows program modules to be modified, assembled, and checked in seconds. Debugging is greatly facilitated by single step trace capability for Z-80 or 8080 programs, with full display of registers, flag status, and the mnemonics of the instruction just executed and the next instruction to be executed.

The PDS development system, comprising six major programs, is available on 8" CP/M-compatible disk, with over 100 pages of documentation, for $99 from Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107, (213) 793-5748.

CIRCLE INQUIRY NO. 337

Disk Copy Software

Xener Corporation has available a fast disk copy program for the Intel MDS family of development systems. The program runs under the ISIS-II operating system and will copy an entire single or double density diskette in less than one minute. The user may optionally specify that the object diskette is to be formatted, and/or that a verification of the object disk is to be performed.

Xener Coporation has observed that Intel's COPY, IDISK, and FORMAT programs perform no verification of the object diskette; thus, the user must copy the newly written diskette to another device to ensure the new disk is readable. Also, since Xener's copy program is a binary copy, it is not limited to copying ISIS-II diskettes. It will copy any standard format single or double density diskette.

The price is $60 and is available from stock on a single or double density ISIS-II diskette. For more information contact Xener Corp., 6641 Backlick Rd., Springfield, VA 22150, (703) 569-5050.

CIRCLE INQUIRY NO. 338

RPG II Compiler for Microcomputers

CRC Systems, Inc. is offering an IBM-compatible RPG II compiler designed to run on a 32K byte microcomputer system. This compiler is compatible with both IBM 360/20 RPG and IBM System 3 RPG II. It is designed to be easily implemented on any microcomputer, whether an 8-bit or 16-bit system.

The bulk of the compiler code is written in a high-level interpretive language which was designed specifically for writing compilers and is completely system independent.

Therefore, since only the compiler's interpreter and run-time routines need to be rewritten in the specific microcomputer's native assembly language, we can deliver a customized compiler in approximately four months.

The CRC Systems RPG II compiler and run-time library is a full implementation of the language. Sequential, indexed-sequential and direct-access disk files are supported. Tape files are also supported.

For delivery we suggest you contact us as soon as posisble, as we are scheduling our deliveries on a first-come, first-serve basis. For more information contact CRC Systems, Inc., 108 Meem Ave., Gaithersburg, MD 20760, (301) 869-6878, Mike Connick, Technical Director.

CIRCLE INQUIRY NO. 339

TI Software

The Kitzmiller Systems Order Entry, Inventory Control, Sales Analysis System is designed to work on the Texas Instruments 990 Computer as well as the 771 Computer. It is written in BASIC and will work on a floppy disk system as well as a hard disk system.

The entire system is menu oriented. This means that it is easy to use and easy to learn. Some of the capabilities of this software are: it will enter orders, print a sales journal, print invoices, print a backorder report, add items to stock, select items to order and create or purge files.

For more information contact Kitzmiller Systems, 252 S. Oxford Ave., Los Angeles, CA 90004, (213) 385-9388.

CIRCLE INQUIRY NO. 340

Investment Analysis

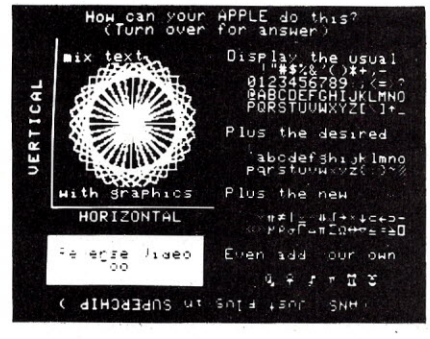
An investment analysis program particularly well suited to real estate investments is now available for use in the Commodore PET personal computer. It can be used by investors, businessmen, real estate salesmen, educators, and students to assist in understanding and making sound investment decisions.

Titled REAL-I and written in BASIC, the program comes complete with software on cassette and an operating manual. It can be obtained for $29 domestic and $32 foreign. Delivery is 4 weeks ARO. To order or for more information contact Applications Research Co., 13460 Robleda Rd., Los Altos Hills, CA 94022. Quantity discounts are available.

CIRCLE INQUIRY NO. 341

Superchip for Apple Computer Adds Text Processing Capabilities

A "Superchip" has been developed which substantially enhances the text processing capabilities of the Apple computer. The ROM firmware chip, which plugs into an Apple computer with no modification required, adds the full ASCII character set, including lower case, plus 31 other useful, non-ASCII characters.



Cost of Superchip is $99.95 plus shipping charges. For more information contact Eclectic Corp., 2830 Walnut Hill Lane, Dallas, TX 75229, (214) 358-1307.

CIRCLE INQUIRY NO. 342

Scientific Software

DPFUN is a comprehensive 16-digit precision scientific subroutine package written for Microsoft extended and disk BASIC interpreters, including TRS-80 Level II BASIC. The thirteen double-precision exponential, logarithmic, trigonometric, and inverse trigonometric functions provide a valuable utility for serious engineering and scientific applications.

DPFUN uses truncated continued fraction algorithms that result in easily entered code, fast execution, and, unlike other empirical approximations, fully exploit the precision available in 64-bit binary floating point notation. The complete set of subroutines occupies about 2.5K.

DPFUN, source code only, is available for $10 postpaid from Miken Optical Co., 53 Abbett Ave., Morristown, NJ 07960.

CIRCLE INQUIRY NO. 343

New Computer Games

GRT Corporation's G/2 Consumer Computer Group is beginning deliveries of its new games series that are compatible with most brands of personal computers.

Also included in initial deliveries is an Extended Basic package for Processor Technology's SOL computer.

For more information contact GRT Corporation, Sunnyvale, CA, (800) 662-9810 California; (800) 538-1770 outside of California, Carter Elliott.

CIRCLE INQUIRY NO. 344

NORTHSHARE™

A Time-Share Disk Basic System is available for users of the North Star Floppy Disk System. Designed to operate with either 8080 or Z-80 processors, NORTHSHARE provides up to four independent users with selectable memory partitions and buffered terminal outputs.

Minimum memory requirements for operation are 24K bytes. There are no special hardware requirements outside of additional terminals and I/O ports to support the multiple users.

System includes one diskette with release 3 North Star BASIC and DOS with NORTHSHARE Supervisor and Documentation package. Price is $48. For more information contact Byte Shop of Westminster, 14300 Beach Blvd., Westminster, CA 92683, (714) 894-9131, Martin Rezmer.

CIRCLE INQUIRY NO. 345

GRAFIX™ Programming Language Highlights Bally Computer Intro

GRAFIX is a custom computer programming language featuring words, symbols, music and graphics developed by Bally for use in its new Bally Computer System.

A decade in development, the new language is the offspring of Bally BASIC and GRASS, the graphics language used to create the special computer effets in the movie "Star Wars."

GRAFIX is a graphic computer language designed specifically for consumers and utilizes the full 256-color capability of the Bally Computer System.

The language permits multi-level programming. This feature allows users to write one program while running another, in effect allowing a limitless number of independent programs to operate on the screen simultaneously.

For more information circle inquiry number on reader service card.

CIRCLE INQUIRY NO. 346

SELECTOR III DBMS

A database management system (DBMS) that allows users of CP/M based microcomputers to enter records and update files interactively, also provides full query and report writer functions.

The system is distributed with a library of predefined record formats in a data dictionary, and programs to manage and report sales activity, inventory, payables, receivables, check register, expenses, appointments and name & address functions.

SELECTOR III is distributed on diskette with source code. Price is $295. For more information contact Micro-Ap, 9807 Davona Dr., San Ramon, CA 94583, (415) 828-6697.

CIRCLE INQUIRY NO. 347

CCA Data Management System

The CCA Data Management System will maintain, sort, and print reports or mailing labels for any type file the user needs. The system can be used for such applications as name and address lists, payroll, A/R, A/P, inventory control, customer lists, and many more. The DMS consists of 15 programs, runs under Micropolis BASIC, and requires a minimum of 32K. A printer is optional.

Records for any file can be added, updated, deleted, scanned for, or inspected. The system allows the user to define the file and field names for each file. The files can also be easily accessed by user written programs for specialized applications.

The report writer allows the user to select such report options as fields, titles, totaling, editing, and record selection.

The CCS Data Management System price is $150. For more information contact Creative Computer Applications, 2218 Glen Canyon Rd., Altadena, CA 91001.

CIRCLE INQUIRY NO. 348

All States Payroll

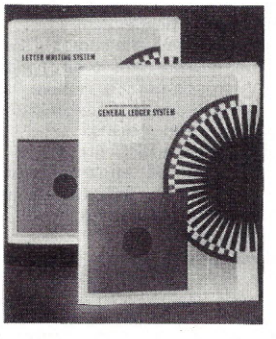
Here is a fully user defined all-states payroll system, which can be used in any state, the District of Columbia, or Canada. Simultaneous multi-state processing of up to four states is also possible. All standard reports with current, month, quarter, and year to date amounts, plus a limited report generator are included.

It runs on a Alpha Micro and is part of the PJA Accounting System which is currently available for $500. For more information contact Payne, Jackson and Associates, 447 E. Fifth Ave., Anchorage, Alaska 99501, (907) 279-2351 or 272-7261. Dealer inquiries invited.

CIRCLE INQUIRY NO. 349

Basic Source Listings for Business Applications

Binary Systems Corporation offers BASIC language source listings, along with programming language and users manuals, for business applications.



Immediately available are source listings and manuals for CPA (Computer Prepared Accounting™), a general ledger system, and Write-On™, an automatic letter-writing system.

Both the CPA and Write-On source listings sell for $75 each which includes users manual and language manual. For more information contact the Micro Store, 634 S. Central Expwy., Richardson, TX 75080.

CIRCLE INQUIRY NO. 350

Client Write Up System

Payne Jackson has a generalized interactive bookkeeping and accounting system, which was written by CPAs for accounting practice. It will take original accounting data as provided by the client and produce all of the major ledgers and journals necessary to maintain a good set of books. In addition, the system will produce the major subsidiary ledgers, statements, vouchers, checks and numerous reports needed to run a small business or non-profit organization.

Operator training is relatively easy since the system is self prompting, chained together, and makes use of data entry defaults and edit controls.

Source code is currently available for $500. An Alpha Micro computer is required. For more information contact Payne, Jackson and Associates, 447 E. Fifth Ave., Anchorage, Alaska 99501 (907) 279-2351 or 272-7261.

CIRCLE INQUIRY NO. 304

Apple II Software

Charles Mann & Associates have added payroll and accounting packages to their Apple II software line.

The payroll packages include Payroll I and Paycheck I. All systems are designed to operate on a single Apple II disk with 32K of RAM. The packages will run weekly, biweekly, semimonthly and monthly payrolls or any combination of these. All new IRS and FICA regulations are incorporated and CMA includes updates as needed for a year in the initial purchase price.

Each system provides report data necessary for state and federal monthly, quarterly and annual filings.

CMA products are priced from $19.95 to $139.95 and are available from local dealers. For more information contact Charles Mann & Associates, Micro Software Div., 1926 S. Veteran Ave., Los Angeles, CA 90025, (213) 473-0244.

CIRCLE INQUIRY NO. 351

6502 Software

The 6502 Program Exchange has three new items for JOLT and TIM owners. Among these is the JAB (Jolt Adaptor Board Kit). The JAB was designed by Forethought Products to interface the Jolt to the KIMSI S-100 interface.

ERAC (Editor and Resident Assembler Controller) was developed for users of the ROM version of the Jolt Resident Assembler ($C900-CFFF).

LEDIP (Line EDitor Program) is a compact (only 1.1K) line-oriented text editor. Readily lending itself to modification or expansion, LEDIP will output source text suitable for usage with the PROM version of the Jolt Resident Assembler ($E800-EFFF).

Price for the JAB Kit is $19 with manual and all parts except the Jolt connectors. Price for ERAC paper tape is $5; manual is $4.50 and source of $0800 version is $12.50. LEDIP price for paper tape is $2.75; manual is $3.25 and cross-assembly is $5. For more information send $1 to The 6502 Program Exchange, 2920 Moana, Reno, NV 89509.

CIRCLE INQUIRY NO. 352

DYNAMO for Microcomputers

Pugh-Roberts Associates, Inc. is offering DYNAMO tailored for Digital Equipment PDP-11V03, MINC, and other LSI-11-based microcomputers. Widely used in dynamic modeling

and simulation of industrial, social, and engineering systems, DYNAMO is noted for its flexibility, ease-of-use, and excellent error detection.

Recorded on 8-inch flexible diskettes, the microcomputer version of DYNAMO is ready to operate on systems using the RT-11 operating system and can be easily converted to similar systems such as the Heathkit H-11 computer.

Because of the relatively inexpensive hardware involved, a DYNAMO simulation capability can now be provided in classrooms, small businesses, engineering groups, and other places where the cost of more expensive hardware cannot be supported.

Mini-DYNAMO can be licensed from Pugh-Roberts Associates, Inc., 5 Lee St., Cambridge, MA 02139, (617) 864-8880.

CIRCLE INQUIRY NO. 353

APL/Z-80 Release 2.0

Vanguard Systems Corporation announces release 2.0 of APL/Z-80, an APL interpreter for Z-80 based microcomputers.

APL/Z-80 is perhaps the most powerful software system every developed for microcomputer systems and offers significant advantages in systems performance and ease of program development over any existing microcomputer system software available today.

APL/Z-80 extends APL to the realm of low cost microcomptuers. However, the power of APL/Z-80 is comparable to APL on a large time sharing computer for many applications.

A workspace containing defined APL/Z-80 functions, implementing each of the primitive functions not present in this version of APL/Z-80 is distributed with each system.

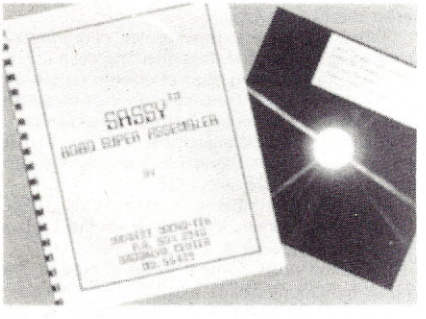
Hardware required is Z-80 CPU, disk drive, either serial ASCII APL console terminal or ASCII keyboard and video display board compatible with the Vector Graphic Flashwriter or Processor Technology VDM 1.

End user license for use on a single CPU is available for $350. For more information contact Vanguard Corp., 6812 San Pedro, San Antonio, TX 78216, (512) 828-0553.

CIRCLE INQUIRY NO. 354

New Assembler

Midwest MicroTek, Inc. has a new assembler, SASSY™ to replace and upgrade the assembler in CP/M operating systems. SASSY is completely compatible with Digital Research's CP/M format.



Also included are standard Intel mnemonics and pseudo-codes, symbol table generation, automatic page numbering, top-of-form control, title block and user control of error and HEX destination.

Price is $75. Available on hard sectored minifloppy disk or soft sectored full-sized single or dual density disks in CP/M format. For more information contact Midwest Micro-Tek, Inc., P.O. Box 29411, Brooklyn Center, MN 55429.

CIRCLE INQUIRY NO. 355

TRS-80 Software

Computer Systems Design, Inc. is offering disk software for the TRS-80. The two-disk system is for those with 125 employees, 200 vendors, 250 customers, 100 accounts and 25-45 jobs. The three-disk systems are for twice those numbers.

For sample reports send $6. Each system is priced at $240. Contact Computer Design, Inc., P.O. Box 735, Yakima, WA 98907, (509) 575-0320.

CIRCLE INQUIRY NO. 356

Program of the Month

PRS is now offering a program of the month package, mailing out software with extended documentation, powerful code and extensive program capabilities packaged in a beautiful cassette or disk folder for business or hobby computerists.

PRS programs support TRS-80 tape, TDL tape, CP/M disks, CUTS tape, and Apple and Tarbell Tape. Programs include a complete instructive text explaining procedures step by step in common English, avoiding technical language.

For more information contact PRS, 257 Central Park West, New York, NY 10024.

CIRCLE INQUIRY NO. 357

Database Management System

Information System Lab's Database Management System (DMS) is a database input/output package for the Alpha Micro computer. It is totally re-entrant with Alpha BASIC and MACRO as host languages.

Particular emphasis is placed on the security and integrity between programs and the database. A password-list is used to grant a separate read or read/write access on an item level. Adding a new item or re-selecting the keyed items do not change existing programs.

The access method used by DMS allows data to be directly retrieved via simple Boolean operations on keyed items. Boolean retrievals are not restricted to keyed items and any number of items may be keyed.

For more information contact Information Systems Laboratory, P.O. Box 4158, Medford, OR 97501, (503) 773-8558.

CIRCLE INQUIRY NO. 358

Information System Language

Information System Lab's Information System Language (ISL^2) is a data storage, manipulation and retrieval software program that provides versatile operations needed in the present-day business and academic environment.

It is the consummation of twenty-two years software and database experience. The system is offered exclusively by ISL to end-users of the Alpha Micro computer system and can be customized by ISL to include any data management application.

The development of ISL^2 has been from the user's viewpoint. This singular attitude alleviates the task of solving enormous data storae and retrieval problems, while significantly reducing user/programming costs.

For more information contact Information Systems Laboratory, P.O. Box 4158, Medford, OR 97501, (503) 773-858.

CIRCLE INQUIRY NO. 359

Billboard Software

A new computer program on a cassette converts an Apple computer system into an automated advertising machine for retail stores, restaurants, banks, hotel lobbies, and trade shows. The program is called "Multi-Message with Interleaved Kaleidoscope." It permits 10 messages (up to 255 characters each) in letters 10% of screen height z 4 lines x 28 characters/line. There can be up to 3 "pages" per message. Characters are "puffed" on at the rate of 2/second, and appear in a bluish-white tint on color TV.

There is a random, dynamic, colored kaleidoscope pattern (of user-determined duration) to attract and hold viewer attention between messages. Instructions for setting up messages are "intermixed" with program code on the cassette, and also appear on screen, so that unsophisticated users are actually "lead through" the operating procedure, rather than simply being "pre-instructed" and then left to their own devices during message-entry.

Samples are available to dealers for $15, if requested on letterhead stationery. For more information contact Connecticut Information Systems Co., 218 Huntington Rd., Bridgeport, CT 06608.

CIRCLE INQUIRY NO. 360

QSM1™ & Documenter-II

A new high-speed sort program for the Tektronix 4051/4907 File Manager, called QSM1, the Intelligent Sort™, uses a combination of internal quicksorts and internal/external merges and offers a 30 to 75 percent improvement in run time, compared to existing sort programs for the 4907.

Also offered are a version of the popular development and debugging aid, Documenter-II and a 4907 comand interface utility call $DEBE. Documenter-II provides a compiler-type listing of 4051 basic programs including a formatted listing of the program, variable cross-reference, statement number cross-reference and more. $DEBE will execute 25 4907 commands through the 4051 function keys.

Prices for QSM1 and Documenter-II start at $300 for a single copy. $DEBE starts at $100. Prices for all products include program source and documentation on a cartridge tape, user instructions and one year of maintenance.

For more information contact Leland C. Sheppard, Dept. I, P.O. Box 60051, Sunnyvale, CA 94086, (408) 733-8651.

CIRCLE INQUIRY NO. 361

Client Write-Up Accounting System

An in-house client write-up accounting system has been developed by CPAs from Phoenix. It utilizes the Horizon computer system with the Soroc IQ-120 terminal and the TI-810 printer.

However, the system can be delivered configured for other North Star BASIC compatible equipment. Performance of the equipment, software and documentation rivals minicomputer systems

The system is retailed by R & B Computer Systems of Scottsdale. The price of $8,595 includes 90-days parts, labor and freight warranty, delivery, set up, employee training and continued assistance by the author-owned firm.

For more information contact R & B Computer Systems, 2916 N. 68th St. #2, Scottsdale, AZ 85251.

CIRCLE INQUIRY NO. 362

6800 Debug Package

The TSC 6800 Debug Package is an extremely powerful and complete assembler language program debugging tool which is capable of simulating all functions of the 6800 microprocessor, including interrupts and I/O operations. It is an ideal substitute for hardware logic analyzers or CPU emulators at only a fraction of the cost.

General features include a line at a time assembler, disassembler, memory interrogation commands, HEX calculator, machine states counter, stack protection, register modifier, and mode control. In all, there are over 50 commands available. The manual includes detailed operating instructions as well as the complete commented source listing.

Requires 9K at $3,000. For more information contact Technical Systems Consultants, Inc., Box 2574, W. Lafayette, IN 47906.

CIRCLE INQUIRY NO. 363

Disk Software for the 8080

The TSC Text Editing System, TSC Text Processing System and TSC Mnemonic Assembler are advanced software packages designed to operate under the CP/M disk operating system.

These 8080 assembly language programs include a fully commented printed source listing. The Editor is line and content oriented obviating the need for memory mapped video displays and commands may be used in a string, line, relative,

local or global sense.

Features include block move and copy, tabs, overlays, append and restrictive column searches. The Editor is "disk-to-disk" meaning any size file that will fit on a disk may be edited regardless of RAM space available.

The Text Processor is an extensive output formatter that processes any number of named edit files. Over 50 commands allow pagination, margin and indent setting, multiple spacing, titling, line centering and various forms of justification.

The Assembler is Intel compatible except for macros, conditional assembly and logical expression operators. All standard pseudo-ops are supported plus paging, titling, HEX or octal listing, line numbers, list suppression, auto field formatting, sorted symbol table and more.

TSC Editor price is $40; Processor is $50 and Assembler is $40. For more information contact Technical Systems Consultants, Inc., P.O. Box 2574, W. Lafayette, IN 47906.

CIRCLE INQUIRY NO. 364

Multivoice Music Software

Newtech Computer Systems offers its MV-80 software on North Star compatible 5" diskette. The MV-80 system generates up to four voices of music on a single inexpensive S-100 bus Newtech Model 6 Music Board.

The disk contains BASIC language music interpreter for entering new music; selection of precoded voice waveform tables; table generating routines for creating new waveforms, including a Fourier synthesis routine; assembly language subroutine that "plays" the music; and ready-to-execute two and four voice demonstration songs for both 2MHz and 4MHz Z-80 processors.

The MV-80 software is easily customized to run on 8080, 8085 or Z-80 processors with clock frequencies of from 1 to 5 MHz. Only two lines of the program must be changed. Memory required is 32K at 0.

Price is $29.95 with 22-page manual. Manual alone is $19.95. For more information contact Newtech Computer Systems, Inc., 230 Clinton St., Brooklyn, NY 11201, (212) 625-6220.

CIRCLE INQUIRY NO. 365

TRS-80 Income Tax Programs

Contract Services Associates offers a full professional Tax System for Level II's with disk and line printer.

The system is sold in modules, with the basic program including the Control Module, priced at $189.95. Subroutines which add the capability to do related Schedules (like Schedule C, Business Income) are priced at $37.95 each.

The complete system involves approximately 150K of programming and took a full year to develop. For more information contact Contract Services Associates, 1846 W. Broadway, Anaheim, CA 92804.

CIRCLE INQUIRY NO. 366

Mailing List Processor

New MAILOUT mailing list processor now includes seven modules — BUILD, SORT, LIST, UPDATE, EXTRACT, LETTER, and HELP. New SORT module can process over a thousand addresses in a file. Sorts on zip or address/title. Merges or extracts sub-files based on codes stored with address.

Prints envelopes or labels in one or more columns. Processes letters against mailing lists. Label size is under user control. Available in Commercial BASIC or Microsoft BASIC versions. Supplied on CP/M type diskette. Dealer license available.

Price is $75. User's manual $5. Send SASE for more information to Center for the Study of the Future, 4110 N.E. Alameda, Portland, OR 97212, (503) 282-5835.

CIRCLE INQUIRY NO. 367

SUPER-SORT

SUPER-SORT features include unequaled sort speed for floppy-based systems, multi-level sort (12-keys) with intermixed sequence indicators, invokable user exits which may be written in COBOL-80, FORT-80 FORTRAN IV, and M80 Assembler, variable length records, fixed length records, variable length keys (defined by column number), and user-defined optimization parameters.

SELECT and EXCLUDE directives allow user-specification of source file extraction criteria. Directive input to SUPER-SORT may be conversational or file-derived. SUPER-SORT may be invoked as a stand-alone program or called as a subroutine from assembler, FORTRAN, or COBOL.

For more information contact Duguid Graphics, 580 Folsom St., San Francisco, CA.

CIRCLE INQUIRY NO. 368

WORD-MASTER

WORD-MASTER provides extensive facilities for text editing based upon "dumb" and therefore inexpensive CRT terminals. In the video edit mode, WORD-MASTER features control key commands which allow bidirectional word tab, line tab and screen tab, left/right word delete and line delete, character/line insert/delete including midline line insert.

Additional control key commands provide quadirectional cursor movement and file paging by line or by screen in either direction. High-speed operation is ensured by keystroke buffering and memory buffering of the floppy disk file being edited.

In the command mode, WORD-MASTER can perform group character-string searches and/or substitutions, merge several floppy diskfiles into the edited file, output edited text sections to additional files on diskette, and move text sections via a queue buffer to new or replicated sections.

Looping and conditional matching round out the command set available to the user. WORD-MASTER supports any conventinal minimum-type CRT with cursor addressing.

For more information contact Duguid Graphics, 580 Folsom St., San Francisco, CA.

CIRCLE INQUIRY NO. 369

Micropolis Disk Users Get ISAM Utility

MAGSAM is an indexed sequential access method (ISAM) for the Micropolis floppy disk subsystems. The package enables users of Micropolis Disk Extended BASIC to create and access data records by a user-defined key, thus eliminating the need for file searches and randomizing routines to locate specific records in a file.

MAGSAM runs as a subroutine to Micropolis BASIC programs and requires 10K of memory over that occupies by the operating system and the calling program.

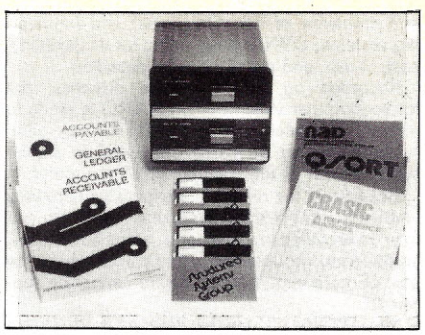
The comprehensive MAGSAM User Guide describes the general principles and applications of ISAM files and the detailed use of MAGSAM including a tutorial section and functional examples with source listings.

The product is distributed on a mini-floppy in source format. A single site license is $75. Dealer and OEM arrangements are also available. User's Guide $5, refundable with order. For more information contact Micro Applications Group, Software Products, 7300 Caldus Ave., Van Nuys, CA 91406.

CIRCLE INQUIRY NO. 370

Accounts Payable for CP/M Systems

Structured Systems Group has a comprehensive Accounts Payable system that projects cash requirements, ages accounts payable, and writes checks in payment of desired invoices or accounts. It is a disbursements management system designed to improve funds control and related record keeping for the small to medium sized business.



Accounts or invoices may be selected for payment individually, or according to user-specified payment dates. The system features Screen Formatting, with foreground and background images on most terminals, for ease of data entry and review.

For more information contact Structured Systems Group, 5208 Claremont Ave., Oakland, CA 94618, David Carlick, Mktg. Dir.

CIRCLE INQUIRY NO. 371

Some Common BASIC Programs

Now mini-FLEX™ users can obtain the quality application programs found in Lon Poole's and Mary Borcher's *Some Common BASIC Programs*. Each of the 67 programs is formatted and referenced automatically through progressive CHAIN commands.

The mini-FLEX editin is on 2 disks. Disk 1 contains 37 programs on finance, investments, mortgage amortization, plotting, interpolation, integration and more. Disk 2 contains 30 programs on matrix arithmetic, statistics, growth rates, federal withholding taxes, calendar dates, metric conversion and much more. Each disk has conversion notes.

The book *Some Common BASIC Programs* is necessary as the user's manual and is $8.50 extra. Each mini-FLEX disk is $16.95. Kansas City Standard tapes are available. For more information contact SSI Publications, 4327 E. Grove St., Phoenix, AZ 85040.

CIRCLE INQUIRY NO. 372

FLEX™ Renumbering System

Renumbering System, by Dave Degler, supports key SWTPC disk commands and may be used like other TSC FLEX utilities. THe disk edition of the Renumbering System supports SAVE, LOAD, KILL, LIST, CAT, return to MON and reenter the FLEX DOS.

Three parameters provide for renumbering starting at a given line, incrementing each line as desired plus allowing user selectable renumbering of certain lines. A number of error messages are supported, including line number overflow.

A cassette edition is available recorded at 300 baud, Kansas City Standard. The cassette supports LOAD, SAVE and LIST.

Since the Renumbering System loads BASIC programs no additional RAM above the original program/interpreter is necessary.

Operation notes come with the program. The FLEX minifloppy disk is $16.95. FLEX full-sized disk is $19.95, and SWTPC compatible cassette is $10.95. For information contact SSI Publications, 4327 E. Grove St., Phoenix, AZ 85040.

CIRCLE INQUIRY NO. 373

Tape Data Query

TDQ is a file management system that provides complete record-keeping capabilities with an inexpensive microcomputer system utilizing audio cassettes. An interactive query language, with English-like commands, facilitates the creation and maintenance of data files. TDQ commands also provide powerful information retrieval capabilities.

Applications to which TDQ is suited are numerous. Among the many commercial functions that can be automated with TDQ are inventory con-

trol, order processing, mailing lists, appointment scheduling and medical record-keeping.

TDQ has been implemented in BASIC and is available on audio cassette tape for the Processor Technology SOL-IIA, the Commodore PET with 8K RAM, and the Radio Shack TRS-80 Level II with 16K RAM. The price of TDQ with user's manual and command reference card is $50. For more information contact H. Geller Computer Systems, P.O. Box 350, New York, NY 10040.

CIRCLE INQUIRY NO. 374

KIM-1 PCROS

PCROS is a Process Control Real-Time Operating System for the KIM-1 microcomputer board. The operating system is designed to function in the 1K KIM-1 RAM. PCROS can control up to twelve switches and is driven by a real-time clock routine that makes use of the KIM-1 timer and interrupt circuitry.

A process control language interpreter has been included as an integral part of PCROS. The interpreter utilizes the on-board KIM-1 keyboard and display. The process control language interpreter provides nine commands for application program development: set switches, hold-seconds current settings (up to 255), hold-quarter-seconds current settings (up to 255), repeat command sequence, reset repeat loop, go to subroutine, return from subroutine, load and execute next program (from cassette tape), and halt. Application programs can contain up to 56 commands.

PCROS on KIM format cassettes with user's manual is priced at $14.95. The assembly listing is available for $24.95. For more more information contact H. Geller Computer Systems, P.O. Box 350, New York, NY 10040.

CIRCLE INQUIRY NO. 375

Reality Expense Analysis Program

REAP is designed for the property owner or manager, providing complete expense information for each building in payment-by-payment and summary format including tax-ready totals for IRS filing.

The Building-Payee report displays expenses for any building, for all or selected payees. A year's payment record including total yearly expense, average monthly expense and total number of payments can all be displayed on-screen at once for any regular paid account. Duplicate or missed payments are easily checked.

The Utility-Summary report displays yearly, year-to-date, or monthly average utility expenses for each building under the categories: electric, gas, water, trash. This enables the user to make quick building-to-building comparisons.

The Tax-Totals report displays totals for each building under the categories: utilities, insurance, repairs and property tax.

REAP is available on cassette with complete documentation for the TRS-80 Level 1 and 2, Apple and PET computers. Each 16K of user memory will handle 500 yearly expense payments. Larger data files are possible by using diskette data storage. Price is $25. Documentation only with sample reports, $5. For more information contact Realty Software Co., 2045 Manhattan Ave., Hermosa Beach, CA 90254.

CIRCLE INQUIRY NO. 376

Customizing CP/M

Starr Computer Systems has developed a generalized relocate-sysgen package for licensed CP/M users who want to add custom features to their system. This package makes customizing CP/M a simple process, and provides greater flexibility than the relocate sysgen programs provided by Digital Research. The source code for the sysgen program is included, so that the sysgen buffer can be expanded.

Send us a disk with your source files for BOOT and CBIOS, and your copy of Digital Research's relocate COM file. Files must be on 8-inch, single density, IBM format disk. We will return the disk within 10 days. We will patch our relocate program (SCSREL.COM) from your Digital Research relocate COM file.

We will also include our sysgen program (SCSGEN.COM), including the source file. We will also alter your source files for BOOT and CBIOS so that system expansion will be easy, and will provide a cold boot sign — on message of the form "customer — specified — part xxK CP/M VER y.yy".

We will also provide extensive step-by-step documentation on how to use these programs to create your custom system. Price is $99.95. For more information contact Starr Computer Systems, 8010 Hascall St., Omaha, NE 68124.

CIRCLE INQUIRY NO. 377

Compatibility Between IBM CP/M Diskettes

It is now possible to transfer diskettes between IBM systems and CP/M systems. Starr Computer Systems has written a series of programs which makes data transfer (by filename) between IBM and CP/M diskettes possible. With these programs, a CP/M dual drive system can read/write IBM 3740 diskettes.

The first program reads the IBM diskette (given the desired track/sector limits) and writes those sectors (in ASCII) to a CP/M file. It can be used to get a directory listing of the files on the IBM diskette.

The second program reads the IBM diskette (given the desired file name) and writes that file (in ASCII) to a CP/M file.

The third program reads a CP/M file and writes that file (in EBCDIC) to the IBM diskette. The IBM file must be pre-allocated cia IBM equipment. The IBM label is updated via the third program to show the correct end of data when the pre-allocated IBM file has been shortened or lengthened on the CP/M system.

These programs provide total file compatibility between a CP/M and an IBM 3740 Data Entry System. IBM data can be read into a CP/M system and processed and vice versa. Price is $99.95. For more information contact Starr Computer Systems, 8010 Hascall St., Omaha, NE 68124.

CIRCLE INQUIRY NO. 378

Software Support for TI Programmables

New Solid State Software™ libraries and specialty pakettes are designed to provide new capabilities for the TI Programmable 58 and 59 and to extend the benefits and power of programmability to new groups of professionals.

A new Math/Utilities Library extends the capabilities of the TI Programmable 59/PC-100A or C combination. For the experienced programmer this library provides many often needed algorithms. The routines in this library range from utility programs such as printer formatting and large-scale plotting to advanced mathematical routines such as hyperbolic functions, interpolation, roots of a function, and differential equations.

For more information contact Texas Instruments, Inc., Consumer Relations, P.O. Box 53, Lubbock, TX 79408.

CIRCLE INQUIRY NO. 379

CBASIC-2

New features that enhance CBASIC's value as the best buy in business BASIC include Chaining which provides automatic transfer of control from program to program. Sophisticated implementation allows the name of the chained program to be constructed at run-time. Integer Variables make CBASIC-2 faster. Control calculations can be made in high-speed, 16-bit binary arithmetic. Multiple Line Functions provide full coding flexibility in a callable function.

XREF produces a sorted cross-reference dictionary of all variables in your program. SAVEMEM reserves space in memory for machine language subroutines, and automatically leads the routine into memory from disk at run time.

Price is $49.95 for CBASIC version-one owners registered with Structured Systems Group. New customer introductory price of $89.95. For information contact Structured Systems Group, 5208 Claremont Ave., Oakland, CA 94618.

CIRCLE INQUIRY NO. 380

Check Maintenance System

The Disk File Check Maintenance System is now available for use on either the BFD-68 or MF-68 6800 disk systems. The system consists of ten (10) programs that will perform complete maintenance of a checking account, and provide all the necessary reports to assist the user both when balancing the account and at tax time.

The complete system is tied together by a MENU program that automatically Chains in the correct program to perform the requested task. The system also maintains its own master file directory, but has the feature of allowing the user to 'back-up' his files in addition to the system backup.

Price of $49.95 includes the program disk and 60-page manual. For more information contact Computerware Software Services, 830 First St., Encinitas, CA 92024.

CIRCLE INQUIRY NO. 381

Home Inventory System

The Home Inventory System is a series of programs designed for creating, updating, and reporting an inventory file that runs under the Smoke Signal Broadcasting Random Disk Operating System. The system will operate on either a one, two or three drive system. The random disk file access allows on-line updating and inquiry of any item in the file (maximum of 511 items).

All functions of the system are available through the "Primary Menu". The reports can be directed to any port (hard-copy or CRT) in either 64 characters/line or 80 characters/line. Reports are sequenced by item number, part number, part name, category code, or location code. Reports of requested location or category codes are available.

Some possible uses for the system include collections (such as antiques, coins, stamps, etc.), wine cellar, food items, or home furnishings for inventory purposes.

Price is $49.95. For more information contact Computerware Software Services, 830 First St., Encinitas, CA 92024.

CIRCLE INQUIRY NO. 382

BASIC Interpreter Controls Integrated Circuit Tester

TBASIC is an extended function BASIC interpreter which controls Pragmatic Designs' ICTN-1 integrated circuit tester module. TBASIC allows users to quickly develop test programs for both standard and integrated circuits, custom modules, and small circuit boards.

TBASIC is a full floating point BASIC with standard BASIC statements such as FOR, NEXT, IF, THEN, GOTO, GOSUB, RETURN, DATA, DIM, INPUT, READ, RESTORE, PRINT and STOP. It also includes the tester control functions of SET, FORCE, MEASURE, CLOCK, RESET, TEST, and EOT.

TBASIC includes standard BASIC functions of +, −, *, /, INT, SQR, and ABS. The special functions of PMAP and DMAP give device failure analysis information on a pin by pin basis for both single tests and the entire test program. Also included are CALL, IN, OUT, PEEK, DPEEK, POKE, and DPOKE; functions useful for linking TBASIC programs to assembly language subroutines or other I/O devices.

TBASIC is available for immediate delivery to ICTM-1 users. Price is $49.95 including all manuals. For more information contact Pragmatic Designs, Inc., 711 Stierlin Rd., Mountain View, CA 94043, (415) 961-3800.

CIRCLE INQUIRY NO. 383

DAISY and WPDAISY

These easy to use on-screen text editors work on the normal video terminal already in your micro-system. Just insert the disk and key in manuscrips or read them from existing disk-files. A set of simple commands allow a full range of editing options.

DAISY allows you to add, delete or change the text by mocing the cursor to the location you want to change, giving a simple command (often just one character), and typing in the change.

WPDAISY is the word processing version of this system, which includes both space and proportional justification (if you have a proportional printer — if not, you can still prepare proportionally justified disk-files for use with a proportional printer). WPDAISY allows you to call disk files while formatting, has 26 in-memory buffers. Also included is a mail merge program, useful in producing form letters and labels.

Prices are TSA/os Version $125 for DAISY, $300 for WPDAISY; CP/M Version $175 for DAISY, $350 for WPDAISY. For more information contact TSA Software, Inc., 39 Williams Dr., Monroe, CT 06468, (203) 261-7963.

CIRCLE INQUIRY NO. 384

Macro Assembler for 8080/Z-80

MACRO-8 from Microsoft is the first 8080/Z-80 assembler to incorporate almost all "big computer" assembler features without sacrificing speed or memory space. The 14K assembler, which comes in a package that includes a linking loader, library manager and cross reference facility, assembles over 1000 lines per minute.

MACRO-80 supports a complete, Intel standard macro facility. Code is assembled in relocatable modules that are easily manipulated with the flexible linking loader. Conditional assembly capability is greatly enhanced by an expanded set of conditional pseudo operations.

Price $200. Manuly only is $15. For more information contact Microsoft, 10800 NE Eighth, Suite 819, Bellevue, WA 98004.

CIRCLE INQUIRY NO. 385

Word Processing Software

Autoscribe—The Paperwork Manager™ is a versatile word processing software package designed to operate on North Star and other popular microcomputers. Documents may be created, revised, viewed, printed, copied, saved, deleted and appended with simple keyboard commands.

Autoscribe can handle individual documents up to 70 single-spaced pages, and can print out such documents at speeds of up to 600 words per minute. Documents are permanently stored on each diskette with an index to the documents.

For more information contact MicroSource, 1425 W. 12th Pl., Tempe, AZ 85281.

CIRCLE INQUIRY NO. 387

Accounting Software

Bookkeeper—The Office Accountant™ is a user-oriented software package designed by a CPA to produce client write-ups. With Bookkeeper, the accounting firm can perform automated financial statement write-up functions with a minimum of employee training.

Reports can be tailored to the client's needs with choice of spacing, underscoring, indentation, header descriptions and nine total levels for statement formatting. In addition, date, percentages and qualifying messages may be added to the financial statements.

Reports available include general ledger, chart of accounts, financial statements, payroll reports and more. Financial statements are provided for each department and combined departments. Sub-accounts are allowed in the general ledger.

For more information contact MicroSource, 1425 W. 12th Pl., Tempe, AZ 85281.

CIRCLE INQUIRY NO. 388

PET BASIC Compleat

Aresco's PET BASIC Compleat is the ideal PET accessory for beginners. Twenty lessons of PET BASIC, including all the major BASIC keywords, cursor control, screen editing, and use of the graphic characters.

Over 400 screensful of information are contained in this 2-cassette tutorial. The 170+ page manual which accompanies the cassette is indexed for quick reference, three-hole punched for easy review, and reproduces all 400 screensful of data (except PET's graphics). Quizzes and exercises add to the fun of learning how to use and program the Commodore PET.

Price is $39.95. For more information or to order contact Aresco, P.O. Box 43, Audubon, PA 19407. No billing or C.O.D.s. Call (215) 631-9052 for M/C and VISA orders.

CIRCLE INQUIRY NO. 389

CP/M for Cromemco Computers

A CBIOS for Cromemco 4FDC controller allows for running all CP/M software on all Cromemco computers. The CBIOS is supplied on diskette with implementation instructions for $50, or sold with CP/M ready to run for $150.

Also available is a Disk Utility Package which runs under CP/M or Cromemco's CDOS and provides five very useful programs.

LISTF lists the directory to a disk file in the form of a SUBMIT or BATCH file.

COPY copies and verifies an entire diskette in less than one minute on PerSci drives.

TRAKTEST tests each track and sector for reading and writing. DISKTEST does a complete test of a diskette by writing and reading bit patterns.

COMPARE compares two diskette files.

Total package supplied on diskette complete with documentation for $50. Source extra.

For more information contact Database, P.O. Box 22212, San Francisco, CA 94122, (415) 664-0778.

CIRCLE INQUIRY NO. 390

8080/Z-80 Word Processing

TEXTWRITER II is a word processing program that can be used to print files created by an editing program. Form letters can be printed from a name and address file and personalized with automatic name insertion. Contracts, specifications, or other documents can be printed from a user defined library of standard paragraphs. Long reports can be segmented into several short sections for easy editing and then linked together automatically when printed by TEXTWRITER II.

The text formatting is controlled by commands inserted within the text. These commands provide control over margins, justification, tabs, paragraphing, page and chapter numbering, and page headings and footings.

TEXTWRITER II is written in 8080 assembly language and can drive a 180 cps printer at full speed. Versions are available for Vector MZ with Lineedit, Micropolis 3.0 or 4.0 with Lineedit, CP/M with ED, and North Star with ALS8.

The Price is $65 for diskette and user's manual or $10 for manual alone. Dealer inquiries invited. For more information contact Organic Software, 1492 Windsor Way, Livermore, CA 94550, (415) 455-4034.

CIRCLE INQUIRY NO. 391

Color Graphics Editor

A very easy-to-use graphics editor software package for use with Intelligent Systems Corporation's INTECOLOR Color Graphics Terminal is available from USDATA Engineering, Inc.

With this software, designated "PEDIT", a user can create any color graphic display by using simple keyboard commands to draw vectors, horizontal and vertical lines, rectangles, and symbols. No prior programming knowledge is required to use PEDIT.

Another significant feature of PEDIT is its "Symbol" capability. Symbols differ from displays in the "sets" of up to 100 symbols can reside in RAM to be added to a display on command from the keyboard or a remote host computer. These "sets" of symbols, like displays, can consist of any graphics or alphanumeric data and can be stored on diskette for later recall.

Price is $750. For more information contact USDATA Engineering, Inc., 14241 Proton Rd., Dallas, TX 75234, (214) 661-9633, Bob Midyett, Jr.

CIRCLE INQUIRY NO. 392

TRS-80 Payroll

Hebbler Software Services has a line of business related packaged programs on disk for the Radio Shack TRS-80 microcomputer.

The first release, DISK PAYROLL, is an interactive payroll system which handles any number of employees. The package features completely automated file handling, output options for the TRS-80 line printer, and a comprehensive manual containing step-by-step instructions.

Price is $59.95. For more information contact Hebbler Software Services, 7142 Elliott Dr., Dallas, TX 75227.

CIRCLE INQUIRY NO. 394

Professional Software for TRS-80

Lifeboat Associates offers a professional disk-based language and utility package for the Radio Shack TRS-80 computer. Written by Microsoft, the package runs on a TRS-80 system with 32K RAM, one or more drives and TRSDOS. the software is supplies on diskettes and consists of:

FORTRAN, a true relocatable machine code compiler for ANSI FORTRAN X3.9 (except COMPLEX variables).

A disk-based Macro Assembler utilizing Zilog mnemonics and producing relocatable code.

A complete library of Subroutines existing as relocatable linkable modules for FORTRAN or assembler programs — e.g., double precision, square root, natural log, transcendentals, etc.

Linking Loader to link-edit and load FORTRAN and assembler modules for execution.

Dist Text Editor to create and modify FORTRAN and assembler programs as disk files; also can be used as a general purpose text editor for correspondence and other documents.

Price with full documentation is $325 per computer system plus $2 shipping ($5 foreign). For more information contact Lifeboat Associates, 164 W. 83rd St., New York, NY 10024, (212) 580-0082. Dealer inquiries invited.

CIRCLE INQUIRY NO. 395

Mail List Program

A general purpose mailing list program has been developed for the Micropolis disk system (Mod II). This package is menu driven and contains seven modules for maximum space savings. Search time per name is greatly reduced due to KEY WORD storage files. There are three user defined variables and the program will sort by any of three different parameters. Two types of listings and a label generator are the output options.

This system requires a minimum of 32K bytes of memory and a single disk drive. For the maximum record size (1000 names and addresses), a 48K system will be required.

Included in both packages are a complete users manual and the program disk. When ordering, specify memory size and/or the upper limit of memory available for program use.

Price for standard Sort Mailing List Package is $39.50. Machine Language Sort Mailing List Package is $79.50. For more information contact Computer Services, P.O. Box 15643, San Diego, CA 92115, (714) 299-4228.

CIRCLE INQUIRY NO. 396

Development Package for Z-80

Zilog has available the Z8 Software Development Package, an assembler and simulator package permitting users to write and debug Z8 software without Z8 microcomputer hardware.

The new package will run on any Zilog MCZ or ZDS system with 60K bytes of emory. The two major components of the package are the assembler for the Z8 PLZ/ASM structured assembly language and the Z8 Simulator.

Since a program can be completely debugged uding the simulator before it is put onto the Z8 microcomputer, the user need only verify time-dependent code.

The Z8 Software Development Package includes a diskette with software and a Z8 technical manual, a Z8 PLZ/ASM programming manual, a Z8 assembler user's guide; a Z8 simulator manual; sample Z8 programs; and sample simulator sessions.

Price is $950. Delivery is 30 days. For more information contact Zilog, 10340 Bubb Rd., Cupertino, CA 95014, (408) 446-4666, Bruce Weiner.

CIRCLE INQUIRY NO. 397

New Software from Ohio Scientific

Ohio Scientific has a software package that makes their Challenger III Series computers compatible with all three of the common computer languages, Microsoft Extended-disk BASIC, 1968 ANSI-standard FORTRAN and 1974 ANSI-standard COBOL.

The software, designated OS-CP/M, is a complete 48K RAM implementation of Digital Research's popular CP/M operating system.

OS-CP/M consists of a CP/M Text Editor, 8080 Assembler, and Dynamic Debugger, as well as a Microsoft 8080 Macro Assembler, Extended-Disk BASIC, FORTRAN and COBOL.

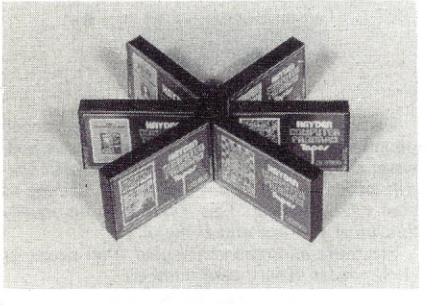
Documentation includes reprinted, and annotated, CP/M and Microsoft manuals plus Ohio Scientific's introduction and overview. The software package also includes three 8-inch floppy diskettes. One diskette is for FORTRAN and BASIC, one for COBOL, and one duplicator.

Price is $600. For more information contact Ohio Scientific, Inc., 1333 S. Chillicothe Rd., Aurora, OH 44202, (216) 562-3101.

CIRCLE INQUIRY NO. 398

Hayden Computer Tapes

Hayden Computer Program Tapes are complete, ready-to-run programs on cassettes, compatible with the PET, KIM, TRS-80 Level I and Level II, Exidy's Sorcerer, and Apple II machines. Full documentation of the programs is available with each tape or in separate books.



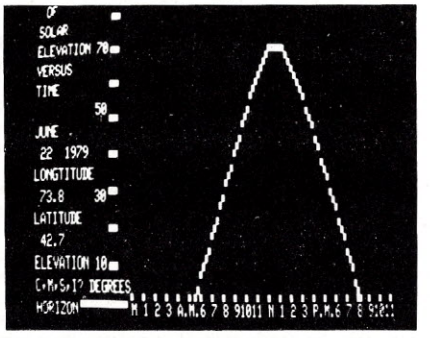
Available now are: Game Playing with BASIC, three cassettes, $9.95 each; The First Book of KIM, three cassettes, $9.95 each; How to Build a Computer-Controlled Robot, one cassette, $14.95; Sargon: A Computer Chess Program, one cassette, $19.95; General Math, one cassette, $9.95; Complex and Matrix Math, one cassette, $9.95; Introductory Engineering Math, one cassette, $9.95.

For more information contact Hayden Book Co., Inc., 50 Essex St., Rochelle Park, NJ 07662.

CIRCLE INQUIRY NO. 399

Program Calculates Sun's Position

SUNGRAPH program calculates and graphs position of the sun. Solar energy designers or anyone interested in how the sun moves will find SUNGRAPH a valuable program. The sun's local elevation and azimuth can be calculated at any location on earth.



Written in TRS-80 Level II BASIC, the program requires 13K bytes of storage. Available on cassette for $49 or diskette for $75. For more information contact Solartek, P.O. Box 298, Guilderland, NY 12084.

CIRCLE INQUIRY NO. 400

North Star Word Processor

IDSWORD is available in North Star BASIC Version 6 under North Star DOS Release 4.0. The comprehensive word processing package, originally developed for the Altair by Interactive Data Systems Inc., has been converted by CW Applications.

IDSWORD is easy to learn, and efficient in use. Prompts are given as complete English sentences and responses are accepted as words rather than numbers. Imbedded commands are not required, since IDSWORD formats the text interactively.

IDSWORD is a modular system starting at $125 for the basic configuration. The complete word processor is priced at $245 for the CRT edit capability or $220 for the editing on the printer capability. Diskettes are included in price. For more information contact CW Applications, 1776 E. Jefferson St., Rockville, MD 20852, (301) 468-0455.

CIRCLE INQUIRY NO. 401

6502 Video Driver Routine

The 6502 Video Driver Routine (VDR) provides the necessary software support for random access video display boards in systems using the 6502 CPU chip. It allows the video board to be interfaced with almost any software package (assemblers, applications programs, BASIC interpreters, etc.) where output is expected to be to a teletype or character oriented type device.

The VDR software manages current display position, cursor movement, line and page overflow, scrolling, and control functions (backspace, cursor left/right, screen clear, etc.). Programmable mode control is maintained over the systems's video board so that graphics, Greek and reverse characters can be displayed on boards so equipped.

Price is $9.50 plus $1 for shipping. Includes object routines on cassette tape (0200 and DD00 versions), 12-page operating manual and full source listing. For more information contact Forethought Products, 87070 Dukhobar Rd., Eugene, OR 97402.

CIRCLE INQUIRY NO. 402

TRS-80 Software Library

AJA Software has available a library of applications programs specifically written for the Radio Shack TRS-80 microcomputer.

Included in this offering are Letter Writer, Accounts Payable, Accounts Receivable, Payroll, General Ledger, Inventory, Sales/Sales Analysis, and a Medical/Professional Billing package. Also available are TRS-80 BASIC and Disk BASIC Tutorial programs.

The software applications packages are priced at $35 each. Delivery guaranteed within 21 days of order. For more information contact AJA Software, P.O. Box 2528, Orange, CA 92669, (714) 774-1270.

CIRCLE INQUIRY NO. 403

Complete Accounting Package

A complete interactive business software package, known as AMCAP (American Microprocessors Complete Accounting Package) is being offered as a product line turnkey business software package by Ohio Scientific on their Challenger series microcomputer systems.

AMCAP is unique in that it is designed for and offered with a microcomputer system that uses a common interactive database. The package includes General Ledger, Receivables, Payables, Inventory, Order Entry, Customer Files, Billing, Payroll, and many other sophisticated on-line business features.

AMCAP is available using a minimum system configuration of dual floppy disks, 48K of memory, keyboard display, and printer.

For more information contact American Intelligent Machines Corp., 30 N. Milwaukee Ave., Prairieview, IL 60069, (312) 634-0076.

CIRCLE INQUIRY NO. 404

COMPRESS

COMPRESS is a Z-80 program which reads in a TDL 12K BASIC program and writes out a compressed version of the BASIC program. Compression is accomplished by concatenating lines, truncating variable names to two bytes, deleting remarks, and deleting unnecessary spaces, tabs, and line feeds, thus the maximum amount of memory is available to the user program for variable storage and string manipulation. Programs developed on large systems may be compressed for execution on smaller systems.

COMPRESS is supplied with a table of jump vectors for console in/out, reader in, punch out, and list out which facilitates interface to any operating.

Price on floppy disk for the Wavemate Jupiter III is $50. For more information contact Advanced Microcomputer Systems, 7641 El Toro Cir., La Palma, CA 90623, (213) 865-5005.

CIRCLE INQUIRY NO. 405

TRS-80 Software from ACS Service

Z-80 Disassembler shows symbolic code for the machine instructions stored in the memory of your TRS-80. Displays addresses and machine code in hexadecimal, ASCII representation, and symbolic instructins, with operands, on video monitor or line printer. Requires Level I or II. Price is $20.

Database Management #1 is a sequential, five-command database management program. Requires Level II Disk BASIC, one disk drive, and 16K RAM. $20 for cassette. Database Management #2 is more complex, uses random files and also requires Disk BASIC and one disk drive, plus 3K RAM. $39.

Inventory program uses sequential files to list stock number, item name, location, how many, cost per unit, number per case, cost per case, and next shipping date. Requires Level II Disk BASIC, one disk drive, and 16K RAM. $20.

All programs come on cassette. Add $7.50 for disk or send diskette with order. For more information contact ACS Service, 2208 Dearborn Dr., Donelson, TN 37214.

CIRCLE INQUIRY NO. 406

Statistical Software

Research Resources Ltd. has a statistical package for SWTP compatible microsystems. The package — name SAM (Statistical Analysis for Microcomputers) — requires a minimum configuration of 32K and a dual floppy disk (mini or standard).

The entire package is conversational and can be used with little or no tuition, making it suitable for teaching statistics.

Version two of this package is now available. New analysis are added at regular intervals and a number of sub-packages are already under development ensuring an increasing flexibility for the system.

For more information contact Research Resources Ltd., P.O. Box 160, Potters Bar, Herts., England. Phone Potters Bar 54737.

CIRCLE INQUIRY NO. 407

General Accounting System

National Software Marketing has four general accounting packages for Wang computers. The packages include PAYROLL, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, and GENERAL LEDGER that will operate on the WCS 20 or WCS 30 systems.

The systems are supplied on three floppy disks each. One floppy already is initialized for the files. Just drop in the disks and the systems are ready to run.

These are all full scale tested systems that required hundreds of hours of development. The software comes with a 30 day return privilege.

Price for each package is $200 plus $10 handling and media fee. For more information contact National Software Marketing Inc., 4701 McKinley St., Hollywood FL 33021.

CIRCLE INQUIRY NO. 408

Text Formatting System

TFS is written in 8080 machine code and is fully integrated with the North Star System. It is also completely 'Load and Go' with the exception of the two byte jump patch to the user's printer drivers.

TFS can justify left and right margins, has automatic paragraph indentation and reverse indentation title page and chapter headings, auto-list numbering, multi-copy capability, macro capabilities, auto page number, and back space commands.

TFS can append files from disk, and if text is larger than user RAM area, one can chain files on disk together with entire format environment saved. TFS also supports a host of commands to alter text, both by string searches and substitution or by editing any specific line. The input line editor is both very simple and extremely powerful. TFS supports file merges and appending two files together to yield one larger file.

Price for TFS is $75 with user's manual. For more information contact Supersoft, P.O. Box 1628. Champaign, IL 61820.

CIRCLE INQUIRY NO. 409

Accounting Software for AM-100™

Alpha Micro has released Version 1.0 of its Alpha Accounting software package. Alpha Accounting is a comprehensive accounting system designed for use with computer systems based upon the Alpha AM-100 CPU card.

The software package consists of five integrated modules and a collection of business subroutines: Alpha General Ledger; Alpha Accounts Receivable; Alpha Accounts Payable; Alpha Order Entry/Inventory Control; Alpha Payroll.

Version 1.0 contains complete programs of accounts receivable accounts payable, general ledger, and payroll including the interface between the packages. The order entry/inventory control program has most maintenance and print programs running, with the balance of the program to be released soon.

Each of the modules contains full documentation and test data. For more information contact Alpha Micro, 17881 Sky Park North, Irvine, CA 92714, (714) 957-1404.

CIRCLE INQUIRY NO. 410

RDA — Data System for North Star

The RDA — Data System is both a fast and powerful database management system. It is fully interfaced to the North Star Disk Operating System. With RDA you have the full power of your computer at your command.

You can store virtually any kind of data without regard to content: RDA takes care of that automatically.

With 18K of user RAM filled with data the longest access time is 0.5 sec. That includes all cross-referencing.

RDA has unlimited cross-reference capability. Each individual word of text becomes a key in the RDA system, therefore all data that pertains to a specific item can be easily found.

RDA is a word oriented database management system, making is almost impossible to accidentally lose a piece of information.

RDA is both simple to use, yet powerful, and even has provisions for a simple security system to avoid the accessing of privileged information.

RDA comes ready to load and go and includes an extensive user's manual complete with a sample session. For more information contact Supersoft, P.O. Box 1628, Champaign, IL 61801.

CIRCLE INQUIRY NO. 411

Video I/O System Software

A video input/output system, from Vector Graphic, features complete compatibility with software written for the Flashwriter II video board.

The new system, called EVIOS — Extended Video Input/Output System, maximizes the capabilities of any video terminal and is designed to allow complete control over every facet of software programming.

The complete package includes a comprehensive manual, interfacing and programming examples, a source listing and a 2708 PROM. Price is $75. For more information contact Vector Graphic Inc., Customer Service, 31364 Via Colinas, Westlake Village, CA 91361, (213) 991-2302.

CIRCLE INQUIRY NO. 412

6800 Disk-Based Software

TSC is distributing software compatible with the FLEX™ operating system found on SWTPC MF-68 minifloppy and DMAF-1 full sized floppy disk systems.

A disk version of TSC's popular Text Editing System is available for $31.50 for the mini (SL68-24D) or $50 for the full-sized (SL68-24F). These allow disk-to-disk editing of named files which means you can edit a file as large as the disk space.

A minifloppy version of the TSC Mnemonic Assembler is $31.50 (SL68-26D) and a full-sized version for $50 (SL68-26F). Assembly may be performed directly to the disk.

The TSC Text Processing System is available for the mini for $40 (SL68-29D) or for the full-sized floppy at $75 (SL68-29F). Text processing is performed on named files with the ability to process multiple files from one command. A macro library file may be automatically loaded on initialization. A separate data file may be read by the Text Processor.

For more information contact Technical Systems Consultants, Inc., Box 2574, W. Lafayette, IN 47906.

CIRCLE INQUIRY NO. 413

Personal Mailing List System

The Personal Mailing System is a series of programs written in Computerware's Super BASIC for maintaining a mailing list on disk. It uses sequential files and can be run under either Smoke Signal Broadcasting DOS or SWTP FLEX.

All programs are under operator control through a menu program. System startup is automatic from BASIC by typing "CHAIN MENU". Address label printing can be directed to any port (0-7). The drive from which the file is run is operator selectable.

Single disk systems may maintain the mailing list on a separate disk. Optional special code and phone numbers may be entered on the file. Label spacing is operator selectable. Labels may be printed out by special codes. Complete file listings may be printed out. A date may be maintained with each record.

Price is $49.95. For more information contact Computerware Software Services, 830 First St., Encinitas, CA 92024.

CIRCLE INQUIRY NO. 414

KISS

The Keyed Indexed Sequential Search (KISS) technique developed by Tascon Corporation is now available fully integrated into MicroSoft's Disk Extended BASIC under ISIS II and CP/M. Depending on key and data length, KISS produces a record search and retrieval operations that are several orders of magnitude faster than currently available file methods.

The absolute maximum number of disk accesses to retrieve any record under control of KISS is three. KISS is comprised of a Mult-Keyed ISAM file manager and a Direct Access file manager that controls logical random records in sizes from 64 bytes through 512 bytes in 64 byte increments.

KISS is also available as a relocatable object module configured for use with FORTRAN and assembler under CP/M; and PL/M, FORTRAN and assembler under ISIS II.

The three section illustrated user guide describes the technical concept, the user interface control and has actual file control examples. Price for manual is $22.50 plus $2.50 for postage and handling. For more information contact EIDOS Systems Corporation, 315 Wilhagan Rd., Nashville, TN 37217, (615) 242-8893.

CIRCLE INQUIRY NO. 461

GAMES

Atari-800™ Personal Computer

The Atari-800 is the top-of-the-line personal computer system and is capable of innumerable, useful, and entertaining applications.

Because of its expandable memory, advanced peripheral components and comprehensive software, the Atari-800 can be tailored for your specific needs and has been designed to change as your needs change. This allows it to be equally functional at home and at the office.

For more information see your Atari dealer or circle reader service card number.

CIRCLE INQUIRY NO. 415

Atari-400™ Personal Computer

The Atari-400 is the affordable home computer that's easy to use even for people who've never used a computer before. It's designed for entertainment, education, and business and household management applications.

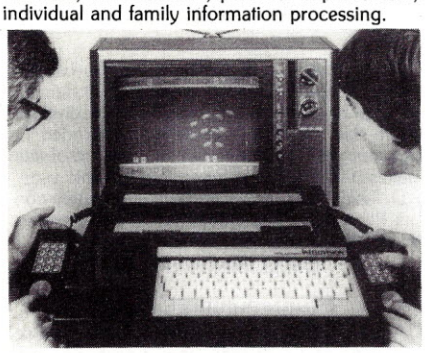
As an educational computer, the Atari-400 can provide computer aided instruction that talks and teaches on home TVs. The Atari-400 plays the most exciting games of any personal computer ever developed, with true-to-life game sounds and colors. The system is so easy to use the games can be played by all members of the family.

For more information see your Atari dealer, or circle reader service number.

CIRCLE INQUIRY NO. 416

Mattel Electronics Intellivision

New for 1979, Intellivision is a computer based system that transforms the home television set into an interacting family center for games, entertainment, self-education, personal improvement, individual and family information processing.



This system includes separately purchased Master Component and Keyboard Component. Software for these combined systems consists of 20 programs to be introduced in 1979 and categorized into networks for sports, gaming, strategy action, children's learning fun, financial services, self-education and personal improvement. TV set not included.

For more information contact Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250, (213) 644-0411.

CIRCLE INQUIRY NO. 417

The Bally Computer System

The forerunner of the computer system, the Bally Professional Arcade, has been incorporated into the system as Level I — The Bally Computer System Video Console. Containing the exclusive, built-in Bally Brain, a powerful microprocessor, the Console has a memory bank of more than 12,000 instructions, with up to 8,000 additional bytes in each optional Videocade Cassette.

Also built into the system are a 5-function, 10-memory calculator, 256 color variationa, stop-action pause control and automatic shut-off. With three arcade games and a 24-key built-in calculator the 2-player model is $299.95 and the 4-player is $329.95. For more information circle the reader service number.

CIRCLE INQUIRY NO. 418

New Videocade Cassettes from Bally

For use with the Bally Computer System Video Console, the eight cassettes bring the total Videocade library to 17, with 36 games.

New cassettes in the Action/Skill Series include 3 video pinball games and Star Battle. Football, Drag Race/Desert Fox, and Demolition Derby/Grand Prix are included in the new Video Sports Series, and Music is being added in the Educational Series.

The new cassettes in the Strategy Series are Checkers/Backgammon and Amazin' Maze/Tic-Tac-Toe. In addition Bally BASIC allows the user to program his own charts, graphs, music and video games.

Additional Videocade cassettes will be offered on a continuing basis, including programs for home finances, business, education and the arts.

Suggested retail price for cassettes ar $19.95 to $24.95; Bally BASIC is $49.95. For more information circle the reader service number.

CIRCLE INQUIRY NO. 419

Video Checkers for TRS-80 and PET

Compu-Quote has converted their popular Video Checkers to run on the TRS-80 and Commodore PET. The two new cassette versions each produce complete checkerboard graphics.

The challenging game is played conforming to International Rules. In accordance with International rules of the game, the program will not accept illegal moves and warns of their entry.

The PET version will play on any 8K machine, while the TRS-80 version requires Level II BASIC and 16K. Complete operating instructions are included with each redundantly recorded cassette.

Price is $14.95. For more information contact Compu-Quote, 6914 Berquist Ave., Canoga Park, CA 91307.

CIRCLE INQUIRY NO. 420

Hangman for Apple II

This program is the old traditional Hangman played with pencil and paper except that the computer will choose the word for you to guess. The disk comes with over 450 words and has routines with ESC to add or change words.

Gallows is in lores and neck stretches when floor drops. This program is extremely educational because it forces the young student to spell correctly whiel holding his attention with an interesting game.

Hangman requires 20K minimum of memory and Apple II with Disk II. Price is $14 postpaid and includes program and text file of over 450 words on disk.

For more information contact Computer Forum, 14052 E. Firestone Blvd., Santa Fe Springs, CA 90670.

CIRCLE INQUIRY NO. 421

Program Catalog for Apple II

This program will catalog all your disk programs by category on one disk. It will keep track of all your programs and which disks they are on as well as keeping notes about the program so you can be sure of the program before you hit the proper key to have this program load and run the program you want.

It also contains numerous routines to manipulate the information. One disk will hold approximately 2,000 listings. The language used is BASIC. Program requires 24K minimum memory, and Apple II with Disk II.

Price is $19 postpaid. Includes program on disk and documentation. For more information contact Computer Forum, 14052 E. Firestone Blvd., Santa Fe Springs, CA 90670.

CIRCLE INQUIRY NO. 422

Mattel Electronics Baseball

Electronic Baseball enables you to have big league baseball action in the palm of your hand. With this game the built-in computer plays defense and controls pitches. You control hitting and base running.

Swing at fast balls, curves and change ups. Simulated game sounds for homeruns, outs, strikes, single, doubles, and triples, and a special sound effect for the end of the game.

There are two player speeds. Pro 1 for minor league play and Pro 2 for big league. Batteries not included. For more information contact Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

CIRCLE INQUIRY NO. 423

Football II from Mattel

You can run, pass, punt, reverse your field, and even kick field goals with the new hand held electronic Football II. The built-in computer controls the action of the defense, you control the offense.

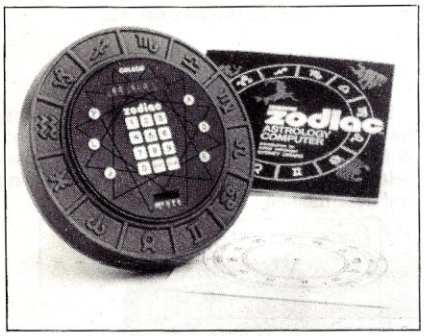
Maneuver your ball carrier around the defense or go for a pass. Hit your receiver downfield. Touchdown! Simulated games sounds include a ref's whistle, victory tune for touchdown and field goal, "charge" on kickoff. Special sound effects when ball possession changes.

Game includes two playing speeds Pro 1 and Pro 2 for the more advanced player. Batteries not included. For more information contact Mattel Electronics, 5150 Rosecrans Ave., Hawthorne, CA 90250.

CIRCLE INQUIRY NO. 424

Astrology from Coleco

Coleco Industries is introducing Zodiac — The Astrology Computer, available this spring for under $50. Using space-age microprocessor technology it provides a complete astrological horoscope with reading of character traits, a prediction for any day in the future, or answers to any questions about what will come to pass.



Using the Zodiac along with the included manual the stars open up their mysteries. You can get a reading of what you should or should not do on any given day; the kind of in-depth information previously available only from a professional astrologer.

For more information contact Coleco Industries, Inc., c/o HWH Enterprises, Inc., 16 E. 52 St., New York, NY 10022.

CIRCLE INQUIRY NO. 425

Quizkid Speller™

The Quizkid Speller can be used for games, or as an educational tool to each spelling in an entertaining way. The unit has a vocabulary of 99 preprogrammed words selected from six levels of difficulty by remedial reading teachers, and three modes of operation.

The device is supplied with a booklet containing illustrations of the 99 words for self-teaching, as well as instructions for many word games.

Price is $29.95 and requires four AA penlight batteries, which are not included. For more information contact National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051.

CIRCLE INQUIRY NO. 426

Diet Computer

Geared for "fitness conscious" consumers in an appearance conscious era, the COMUS C-6 Diet Computer is a revolutionary new microcomputer which quickly computes an individual's proper caloric needs based on inputs of the keyword "SHAPE" — Sex, Height, Age, Pounds, and Exercise.

Using simple entry techniques, the user feeds in the essential data of his sex, height in inches, age in years, weight in pounds, and 24 hours of exercise levels by code. Exercise levels are classified by degree of physical exertion into five categories from sleep to tennis.

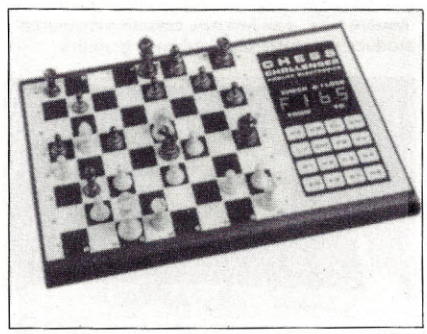
About the size of a pocket notebook, the COMUS C-6 Diet Computer comes in a durable off-white plstic case with an 8-digit LED red display. Inside its components include a 4-bit microcomputer with a ROM capacity of 2,000 bytes and a RAM capacity of 128 bytes. The unit has C-MOS memory and three transistors and six diodes.

Price is $34.95 and includes Computer Instructions, Calorie Counter, Exercise Levels Listing, and Calculator Instructions. For more information contact Comus, Inc., 4550 Cascade Rd., Grand Rapids, MI 49506, (800) 253-7930.

CIRCLE INQUIRY NO. 427

Challenger Games

Chess Challenger® "7" invites chess players to learn, improve and match their skills against a computer's mind. Seven levels of playing difficulty. Numerous other features including plays against you, plays against itself, changes side in mid-game on any move, solves mate-in-two problems and chess by mail.



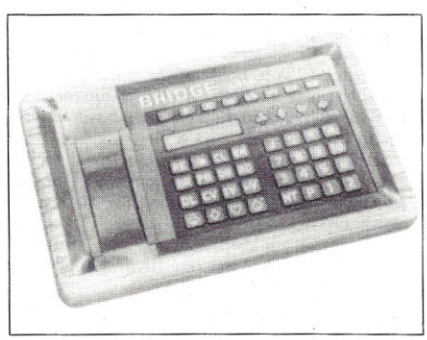
Backgammon Challenger allows the human opponent to throw the dice. Uses all the strategies of the game including playing a running game, hit and run, blocking and bear off games.

For more information contact Fidelity Electronics, Ltd., 5245 W. Diversey Ave., Chicago, IL 60639, (312) 237-8090.

CIRCLE INQUIRY NO. 428

Bridge Challenger

This popular card game is now housed in the mind of a microprocessor. Two computers are in one housing. Bids the popular point count systems. Has superb playing ability. The device can be your partner (plays one hand), can be your opponents (plays two hands) or it's you against the computer (plays all three hands).



Special features include optic scanner which reads custom playing cards; during bidding, uses well-known conventions; during play, will use popular defensive play, finesse and squeezes.

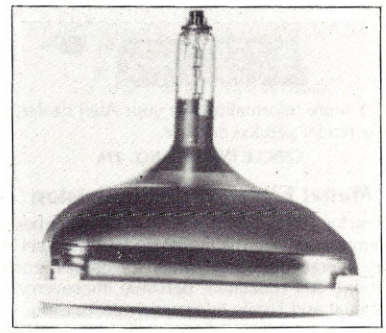
For more information contact Fidelity Electronics, Ltd., 5245 W. Diversey Ave., Chicago, IL 60639, (312) 237-8090.

CIRCLE INQUIRY NO. 429

MISCELLANEOUS

15-Inch Data Display Tube

The 370HCB4 offers high resolution (1500 lines per inch), uniform spot size, low cost, electrostatic focusing, 110-degree deflection angle, electromagnetic deflection and Panasonic exclusive direct-etch non-glare face surface.



The introduction of this high-resolution display tube is in direct response to the market demand for high-quality, low-cost, large-screen displays. While the 370HCB4 is primarily intended for alphanumeric applications, its high resolution makes it ideally suited for various graphic uses.

Delivery is 90 days. For more information contact Panasonic, One Panasonic Way, Secaucus, NJ 07094, (201) 348-7271, Bill Parkin.

CIRCLE INQUIRY NO. 430

Programming Course

A new BASIC language programming course, consisting of 12 cassette tapes coordinated with 12 printed texts, is available from Williamsville Publishing Company.

The tape and text course is intended for the microcomputer hobbyist, the small business computer user and students enrolled in courses that require proficient use of the language.

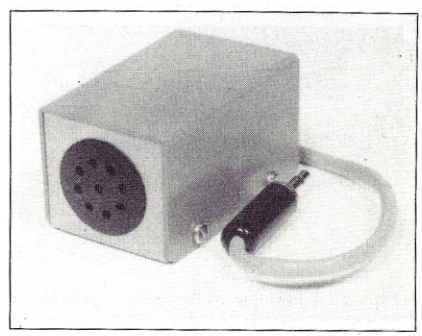
The learner is afforded the opportunity to hear on tape in-depth explanations of what he is seeing in the text at the same time.

This BASIC tape and text course is divided into three modules, Programming in BASIC, Intermediate BASIC, Advanced BASIC. Price is $48. Individuals modules sell for $19.95 each. For more information contact Williamsville Publishing Co., Box 237, Williamsville, NY 14221, William R. Parks, (716) 634-8334.

CIRCLE INQUIRY NO. 431

TRS-80 TBUFF

Cassette drive failure of the TRS-80 is caused by a phenomenon known as microwelding, caused by excessive current and heat build-up in the TRS-80 cassette control reed relay.



The microwelding is further aided by a slight, self-holding, electromagnetic force induced by the high recorder current. This is why, in most cases, the hang-up goes away when the cassette is manually turned off.

The TBUFF module plugs in series with the "REMOTE" cable between the TRS-80 and the recorder. TBUFF reduces practically nothing the current passed through the reed relay in the TRS-80.

Price is $9.95. For more information contact Web Associates, P.O. Box 60, Monrovia, CA 91016.

CIRCLE INQUIRY NO. 432

TRS-80 Beeper

TBEEP is a low cost, easy to install and easy to use software controlled beeper which can be used to signal a computer operator that an error has occurred or that some additional action must be taken to continue processing.

TBEEP produces a clear, distinct tone similar to that of a pocket pager and is programmed by a minimum of two Level II BASIC instructions or by four machine language instructions. Within some constraints, the length of the beep is also software controllable.

TBEEP is powered by a long life battery (included) and simply plugged in line with the AUX cable to the cassette, not interfering with or making any sound during normal cassette operations.

TBEEP comes in a small neat box and is compatible with all TRS-80 Level II configurations, including disk. Price is $18.95. For more information contact Web Associates, P.O. Box 60-N, Monrovia, CA 91016.

CIRCLE INQUIRY NO. 433

Conductive Leg Strap Protects Equipment from Static Electricity

The W-7080 is a personal conductive leg strap to prevent static electricity damage to microcircuits during assembly, handling, shipping or quality control operations is available from Wescorp.

A flexible conductive wire links the shoe strap to a plastic leg strap held firmly and snugly against the leg by a velcro hook-and-loop fastener. A resistor is built into the wire to prevent electrical shock if the worker should accidently step on an open wire.

Price with resistor is $10. For more information contact Wescorp, 1155 Terra Bella Ave., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 434

Desk for Microcomputer Systems

A desk specifically designed to house a business or personal microcomputer system is available from Computer Systems Design. The MICRODESK allows the keyboard and video display to be placed at a convenient typing height.

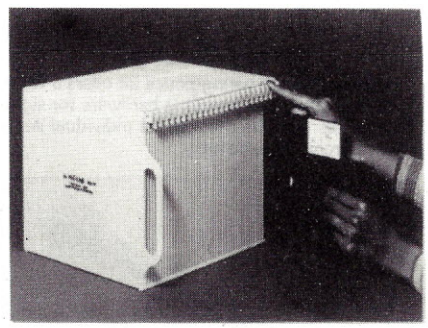
The Microdesk can be assembled in a few minutes without tools. The desk is constructed of high density particle board covered with a hard plastic walnut-grained laminate.

For more information contact Computer Systems Design, 906 N. Main, Wichita, KS 67214.

CIRCLE INQUIRY NO. 435

Pushbutton Diskette Storage

A new diskette storage and retrieval system features instant diskette retrieval at the push of a button. The system helps keep diskettes neat, clean and away from office hazards.



The high impact plastic housing is highly portable and stackable. Available with 15 slot storage capacity for $69.96; 30 slot unit for $119.95 and 50 slot system for $179.95.

For more information contact Printcraft Systems, Inc., 11-17 Beach St., New York, NY 10013

CIRCLE INQUIRY NO. 436

High Speed, Low Cost Tape Storage

The BETA-1 is a universal tape storage device that interfaces to most popular microcomputers, including non-S100 bus systems. This unit plugs directly into a standard 8-bit parallel port. Serial port connection is offered as an option.

The high speed digital tape transport features random seek at more than 100 inches per second, with average access times in 10 seconds or less, and loading time at 8,000 bits per second.

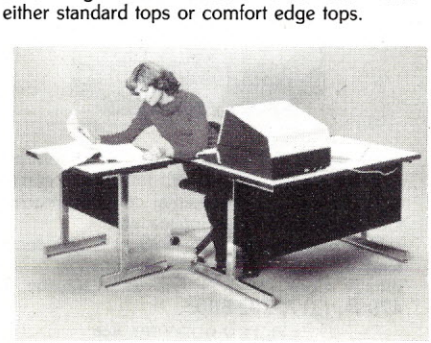
An internal 8035 microprocessor with a 1K byte program and high level tape operating system assure easy-to-use operation.

Price is $399 fully assembled and tested in single units. Quantity discounts are available to qualified dealers. For more information contact MECA, 7026 O.W.S. Rd., Yucca Valley, CA 92284, (714) 365-7686.

CIRCLE INQUIRY NO. 437

Work Station Furniture

Smith System offers two complete lines of CRT work stations. One line features the comfort edge top designed for use with CRT terminals. Top sizes range from 24"x30" to 30"x60" with either standard tops or comfort edge tops.



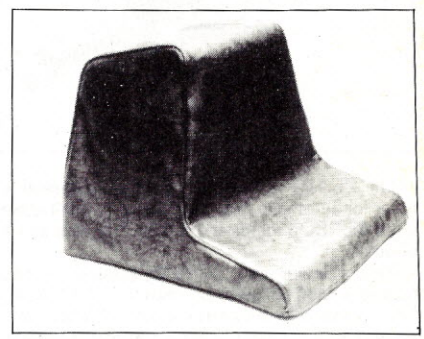
Work stations are available with modesty panels and storage shelves. Chrome or enable T-Bar legs come in working height or standing height. Other computer furniture available includes files and various tape storage systems.

For more information contact Smith System Manufacturing Co., P.O. Box 43515, St. Paul, MN 55164.

CIRCLE INQUIRY NO. 438

Computer Canopy Dust Covers

Digital Dynamics offers aline of high quality computer canopy dust covers for several of the more popular brands of microcomputers, terminals and peripherals.



All computer canopy covers are made of heavy-duty, three-ply, upholstery grade vinyl to provide good looking protection against dust, dirt and sticky fingers.

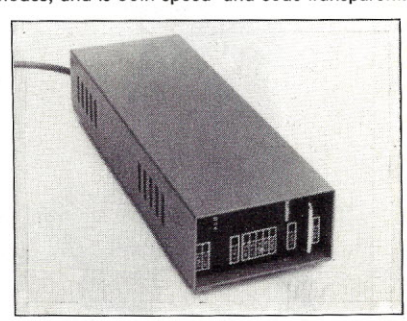
Covers are made in textured walnut. A choice of eleven other colors is available for a slight added charge.

Prices range from $12.95 to $16.95, plus shipping. For more information contact Digital Dynamics Inc., P.O. Box 27243, San Antonio, TX 78227.

CIRCLE INQUIRY NO. 439

Asynchronous Line Driver

This asynchronous line driver (ALD) provides half- or full-duplex data transmission over two- or four-wire facilities of up to 14 miles. The ALD operates in point-topoint or multi-point/polled modes, and is both speed- and code-transparent.



Each ALD unit contains complete built-in diagnostic capabilities, including analog and digital local loopback and 8 LED diagnostic indicators, all accessible from the front panel.

Price is $280 for single units. For more information contact Prentice Corp., 795 San Antonio Rd., Palo Alto, CA 94303, (415) 494-7225.

CIRCLE INQUIRY NO. 440

Mag Tapes

K L Electronics has a line of certified cassette tapes in quality digital-style 5 screw housings with slide write protect switches. Price begins at 10 for $19.50 for 300 foot (C-64) cassettes.

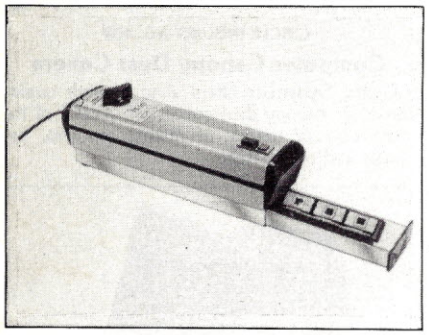
Also available is their regular line of high output, low noise audio cassettes. In 5 screw housings they are excellent for TRS-80 and PET use. Price starts at 10 for $6.25 for C-10 and 10 for $8 for C-30.

All cassettes are warranted. For more information contact K L Electronics, Box 86, Montgomeryville, PA 18936, (215) 257-8195.

CIRCLE INQUIRY NO. 441

EPROM Erasing Lamps

Two new compact EPROM-erasing ultraviolet lamps are available from Spectronics Corporation. The Spectroline PE-14 is small and designed especially for small system users and computer hobbyists.



The PE-14T is the same, but has a 60-minute timer for automatic shut-off. Both lamps will erase up to 6 EPROM chips at one time in as little as 14 minutes.

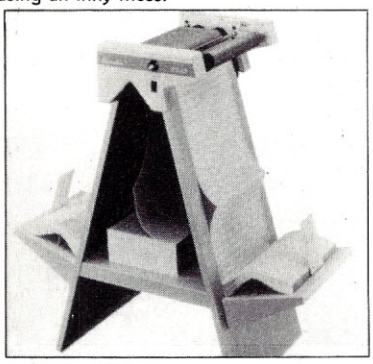
Both Spectroline EPROM-erasing lamps feature a high intensity shortwave UV (254nm) tube, a specially-designed specular reflector, and an exclusive V-shape holding tray that maintains up to 6 chips at a constant exposure distance.

For more information contact Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590.

CIRCLE INQUIRY NO. 442

6325 A-Frame Decollator

The Swingline Model 6325 A-Frame Decollator is a high speed "waterfall" decollator which separates a full box of carbon and carbonless computer print-outs into neat stacks. The separated continuous-carbon is easily and neatly removed from the carbon pick-up spool without causing an inky mess.



The 6325 will handle from 13 to 140 pound bond paper and up to 15 inches wide. It will even decollate carbonless paper. For more information contact The Swingline Co., 32-00 Skillman Ave., Long Island City, NY 11101.

CIRCLE INQUIRY NO. 443

Modules & Controllers

The Game Handset Module provides a convenient game interface to the PET 2001 personal computer and allows two players to sit back away from the computer keyboard while playing their favorite game. The module consists of two handsets, cables, PET adapter plug, and a two-game cassette tape. Instructions for modifying existing games are also included.

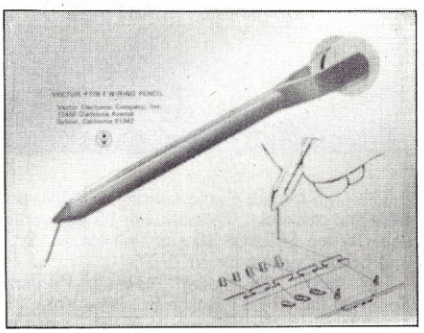
The AC Controller provides control of four independent 110 VAC circuits, with a maximum loading of 1200 watts. The Controller requires only 4 bits of either the PET IEEE-488 bus or the parallel user port.

For more information contact NU Energy Systems, 24256 Walnut St., Lomita, CA 90717.

CIRCLE INQUIRY NO. 444

Wiring Pencil Kit

A money-saving wiring pencil kit offers a variety of tools and breadboarding hardware for significantly less than the price of the individual items when purchased separately.



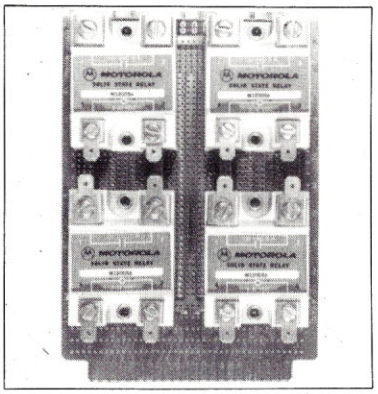
Heart of the Model 55X kit is Vector Electronic's improved P178-1 wiring pencil with a 400 foot spool of 36 gauge insulated wire.

Price of 55X kit is $13.90 or the P178-1 pencils may be purchased separately for $7.95. For more information contact Vector Electronic Co., 12460 Gladstone Ave., Sylmar, CA 91342.

CIRCLE INQUIRY NO. 445

Solid State Relay Module

Wintek Corporation has added a relay module to their line of 6800 single board computers and real world interface modules. The relay module contains 4 solid state relays for switching 5 or 10



amps at 120 or 240 volts for computer control of motors, pumps, lamps, etc. for energy control, traffic control, environmental controls, machine tool control and other applications.

Unit prices range from $99 to $249 depending on options. For more information contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904; (317) 742-6802.

CIRCLE INQUIRY NO. 446

Computer Programming Concepts Course from Info 3

A new self-study course from Info 3 on computer programming concepts presents key principles and concepts common to all business programming languages. The course is designed to bridge the gap between their Computer Concepts for Small Business course and their programming courses on COBOL and RPG II.

Computer Programming Concepts is an audio-cassette course with a coordinated workbook containing over 100 pages of illustrative materials, exercises, references and take approximately six to eight hours to complete.

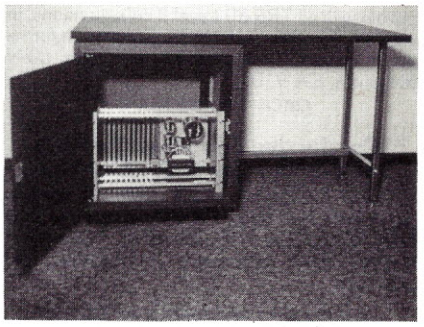
Price is $145. For more information contact Info 3, 21250 Califa St., Woodland Hills, CA 91367, (213) 999-5753.

CIRCLE INQUIRY NO. 447

Desk and CPU Cabinet

Now you can combine the superior performance of your own computer system with the beauty and convenience of our new work station.

Available with a 24"x48" or 32"x60" black laminant desk top. The unit comes with 26" chrome legs with cross brace and adjustable levelers and attaches to CPU cabinet.



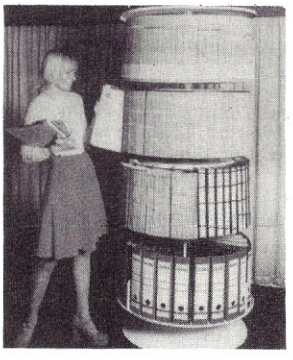
Comes with simulated walnut grain finish with black laminant toe-kick, bronze (clear) plexiglass door with chrome hardware and magnetic lock, removable back panel and more.

Price is $290. For more information contact Group Two, 4901 Morena Blvd., Suite 305, San Diego, CA 92117, (714) 270-6201.

CIRCLE INQUIRY NO. 448

Multi-Purpose File

The RotaScan Multi-Purpose File can be adapted for folders, ringbinders, manuals, computer printout, microfilm, reference cards and a variety of other media.



Each tier has metal dividers which can be used for primary indexing and a customized backstop which makes it possible to house media of several different sizes on the same tier if necessary.

Circular concept gives large filing capacity in minimum floor space. Units available from one to six tiers.

For more information contact RotaScan Retrieval Systems, 270 Greenwich Ave., Greenwich, CT 06830.

CIRCLE INQUIRY NO. 449

Z-80 Patch for MITS Extended BASIC

By Alan R. Miller, Contributing Editor

The Zilog Z-80 microprocessor is an 8080 super chip. It can perform all of the 8080 instructions plus many additional instructions such as relative jumps, double register arithmetic, block move and search, input and output from any register, and bit manipulation. There is, however, one type of instruction that is not compatible with the 8080. Both logical and arithmetic instructions affect the parity flag in the 8080. But in the Z-80, the parity flag does double duty. For logical instructions, the parity flag is set just as it is for the 8080. For arithmetic instructions, however, the flag is used to indicate overflow.

MITS BASIC uses conditional jumps, calls and returns based on the condition of the parity flag. Unfortunately, these conditional statements occur after arithmetic instructions. Consequently, MITS BASIC will run on an 8080 but not on a Z-80.

MITS Extended BASIC, written by Microsoft, is so much better than any other BASIC that is worth spending time trying to get it going. There is a full text editor, and variables can be implicitly or explicitly typed as single precision, double precision, integer or real. The IF.. THEN.. ELSE construction is available, and can be nested. Tabs and lower case are acceptable on input, and the output can be formatted. 3Martin Gray (in the March 1977 issue of INTERFACE AGE) gave a set of patches needed ot make MITS 3.2 Extended BASIC run on a Z-80. The patches consist of six jumps added to BASIC and some additional instructions so that the partiy flag can be properly set.

Version 4.1 of MITS Extended BASIC has several additional features not available in version 3.2. For example, the command AUTO will automatically start each line with a number. The command RENUM can be used to renumber them when it's necessary to insert something between lines 104 and 105. The terminal width can be changed after initialization by giving the WIDTH command. Octal and hexadecimal constants can be entered by putting an &0 and &H in front of the number, and decimal numbers can be converted to octal and HEX with the functions OCT$ and HEX$.

Although the 4.1 version is about 4K bytes longer than the 3.2 versions, the incompatible 8080 code is identical, although located in a different place. After finding the new locations and making the patches, the 4.1 version runs on the Z-80 just as good as new.

The patching program given by Martin Gray was written with the TDL relocating assembler. This assembler has a number of features that are not available on other 8080/Z-80 assemblers. In particular, the assembler directives (pseudo-ops) include LOC and RELOC so that machine code for two different locations can be interspersed. Gray used this feature to intermix the jumps from BASIC with the code at the jump location.

The TDL assembler I have is not disk oriented, so I would rather assemble Z-80 code using CP/M. In this case, the Z-80 instructions are generated with macros that can be in a separate macro library. The assembly listing shown in Program Listing 1 gives the patches for BASIC version 4.1. Most of the lines contain a plus symbol between the address and the machine code. The plus symbols indicate lines that are generated by macros and are not present in the original source program. The two Z-80 instructions SET and RES are generated by macros (although for some reason SET must be spelled SETB or something other than SET).

The six patches to BASIC appear first, then comes a block of 86 bytes that can be put up out of the way (EF00 HEX in this case). The North Star DOS uses the region E800 to EBFF HEX, so 1K of memory at EC00 to EFFF HEX can be used for stack and general scratch-pad use. Just be sure that this block is above the region you have initialized BASIC for. If the value of VERS41 is changed from –1 to zero, the program will assembled the patches for version 3.2.

After assembling the main block (it's short enough to easily be done by hand), load BASIC but don't start it up. Patch in the six jumps. Since there are now two non-contiguous blocks, BASIC and the new block will have to be loaded from two separate files. To avoid this problem, I have included a block move routine that will automatically put the two parts in their proper places.

The short program given in Program Listing 2 can be used with North Star DOS, even though part of DOS lies in the region used by BASIC. Assemble this second program at 4000 HEX. The routine uses Z-80 relative jumps rather than subroutines and 8080 absolute jumps, so it can actually run anywhere. Place the block patch at 4030 HEX and BASIC at 4090 HEX.

Now save the whole works starting at 4000 HEX for 61 blocks (of 256 bytes each). When you want to run BASIC, load the patched file at 4000 HEX, then branch to the address 4000 HEX. The header program will first move the block patch to its location, then move BASIC down to zero, and finally jump to address zero to start up BASIC.

If the combination is saved on a North Star disk using the name BASIC4, merely type GO BASIC4 to start up.□

Program Follows

PROGRAM 1

```
                ; Z80 PATCH FØR MITS EXTENDED BASIC
                ;
                ;
                ; PRØGRAMMED BY ALAN R. MILLER
                ; NEW MEXICØ TECH, SØCØRRØ, NM  87801
                ;  505-835-5619          JUNE 30, 1978
                ;
                ;
EF00 =          MAIN    EQU     0EF00H  ;LØCATIØN ØF MAIN PATCH
                ;
FFFF =          VERS41  EQU     -1      ;0=VER 3.2, -1=VER 4.1
                ;
                        IF      VERS41  ;VERSIØN 4.1
                ;
                        TITLE   'Z80 PATCH FØR BASIC 4.1'
                ;
164A =          LPAT1   EQU     164AH
1B16 =          LPAT2   EQU     1B16H
32CE =          LPAT3   EQU     32CEH
1C4D =          LPAT4   EQU     1C4DH
2A66 =          LPAT5   EQU     2A66H
E59F =          ØFF5    EQU     -1A61H
                ;
                        ELSE            ;VERSIØN 3.2
                ;
                        TITLE   'Z80 PATCH FØR BASIC 3.2'
                ;
                LPAT1   EQU     0CEAH
                LPAT2   EQU     10BCH
                LPAT3   EQU     229AH
                LPAT4   EQU     118CH
                LPAT5   EQU     1A82H
                ØFF5    EQU     -117DH
                        ENDIF
                ;
                PATCH   MACRØ   ADDR,ØFFST,ØPCØDE,EXTRA
                        LØCAL   SKIP
                        PUSH    PSW     ;;SAVE STATUS
                        IF      NØT NUL EXTRA
                        SUI     5       ;;FØR ØNLY ØNE PATCH
                        ENDIF
                        ANA     A       ;;GET PARITY
                        ØPCØDE  SKIP    ;;JPØ ØR JPE
                        PØP     PSW
                        JMP     ADDR+3
                SKIP:   PØP     PSW
                        JMP     ADDR+ØFFST
```

```
                PAT1:   PATCH   PAT11,13H,JPØ
EF13+F5                 PUSH    PSW
EF14+A7                 ANA     A
EF15+E21CEF             JPØ     ??0001
EF18+F1                 PØP     PSW
EF19+C34D16             JMP     PAT11+3
EF1C+F1         ??0001: PØP     PSW
EF1D+C35D16             JMP     PAT11+13H
                PAT2:   PATCH   PAT22,4,JPØ
EF20+F5                 PUSH    PSW
EF21+A7                 ANA     A
EF22+E229EF             JPØ     ??0002
EF25+F1                 PØP     PSW
EF26+C3191B             JMP     PAT22+3
EF29+F1         ??0002: PØP     PSW
EF2A+C31A1B             JMP     PAT22+4
                PAT3:   PATCH   PAT33,5AH,JPE,<ANA      A>
EF2D+F5                 PUSH    PSW
EF2E+D605               SUI     5
EF30+A7                 ANA     A
EF31+EA38EF             JPE     ??0003
EF34+F1                 PØP     PSW
EF35+C3D132             JMP     PAT33+3
EF38+F1         ??0003: PØP     PSW
EF39+C32833             JMP     PAT33+5AH
                PAT4:   PATCH   PAT44,0FFECH,JPØ
EF3C+F5                 PUSH    PSW
EF3D+A7                 ANA     A
EF3E+E245EF             JPØ     ??0004
EF41+F1                 PØP     PSW
EF42+C3501C             JMP     PAT44+3
EF45+F1         ??0004: PØP     PSW
EF46+C3391C             JMP     PAT44+0FFECH
                PAT5:   PATCH   PAT55,ØFF5,JPE
EF49+F5                 PUSH    PSW
EF4A+A7                 ANA     A
EF4B+EA52EF             JPE     ??0005
EF4E+F1                 PØP     PSW
EF4F+C3692A             JMP     PAT55+3
EF52+F1         ??0005: PØP     PSW
EF53+C30510             JMP     PAT55+ØFF5
EF56                    END
```

```
164A LPAT1      1B16 LPAT2      32CE LPAT3      1C4D LPAT4
2A66 LPAT5      EF00 MAIN       E59F ØFF5       164A PAT11
EF13 PAT1       1B16 PAT22      EF20 PAT2       32CE PAT33
EF2D PAT3       1C4D PAT44      EF3C PAT4       2A66 PAT55
EF49 PAT5       EF00 RST6       EF0E UP1        FFFF VERS41

B>
```

```
                        ENDM
                SETB    MACRØ   ?N,?R   ;;Z80 INSTRUCTIØN
                        DB      0CBH,?N*8+?R+0C0H
                        ENDM
                RES     MACRØ   ?N,?R   ;;Z80 INSTRUCTIØN
                        DB      0CBH,?N*8+?R+80H
                        ENDM
                ;
                ; PATCH RST 6
                ;
0035            ØRG     35H
0035 C300EF             JMP     MAIN    ;START ØF CØDE
                ;
164A            ØRG     LPAT1
164A C313EF     PAT11:  JMP     PAT1
                ;
1B16            ØRG     LPAT2
1B16 C320EF     PAT22:  JMP     PAT2
                ;
32CE            ØRG     LPAT3
32CE C32DEF     PAT33:  JMP     PAT3
                ;
1C4D            ØRG     LPAT4
1C4D C33CEF     PAT44:  JMP     PAT4
                ;
2A66            ØRG     LPAT5
2A66 C349EF     PAT55:  JMP     PAT5
                ;
                ; PATCH FØR RST 6
                ;
EF00            ØRG     MAIN
                ;
EF00 3D         RST6:   DCR     A
EF01 3D                 DCR     A
EF02 3D                 DCR     A
EF03 F5                 PUSH    PSW
EF04 E3                 XTHL
EF05 A7                 ANA     A       ;GET PARITY
EF06 EA0EEF             JPE     UP1
                        RES     2,L     ;Z80 RESET PARITY
EF09+CB95               DB      0CBH,2*8+L+80H
EF0B E3                 XTHL
EF0C F1                 PØP     PSW
EF0D C9                 RET
                UP1:    SETB    2,L     ;Z80 SET PARITY
EF0E+CBD5               DB      0CBH,2*8+L+0C0H
EF10 E3                 XTHL
EF11 F1                 PØP     PSW
EF12 C9                 RET
                ;
                ; INDIVIDUAL PATCHES
                ;
```

PROGRAM 2

```
                ; PRØGRAM TØ MØVE Z80 PATCH TØ EF00
                ; AND 4.1 EXTENDED BASIC TØ ZERØ
                ;
                ; CAN BE PLACED ANYWHERE SINCE ALL
                ; INSTRUCTIØNS ARE RELØCATABLE
                ;
                ; WRITTEN BY ALAN R. MILLER
                ;
                        TITLE   'MITS 4.1 BASIC FØR Z80'
                ;
                        MACLIB  Z8080   ;GET Z80 ØPCØDES
                ;
FFFF =          Z80M    EQU     -1      ;SET Z80 MØDE
                ;
4000            ØRG     4000H
4000 31A0EF             LXI     SP,0EFA0H  ;STACK ØUT ØF THE WAY
4003 2100EF             LXI     H,0EF00H  ;PATCH START
4006 1156EF             LXI     D,0EF56H  ;PATCH END
4009 013040             LXI     B,4030H
400C 0A         MØV1:   LDAX    B
400D 77                 MØV     M,A
400E 23                 INX     H
400F 03                 INX     B
4010 B7                 ØRA     A
4011 E5                 PUSH    H
                        DSBC    D
4012+ED52
4014 E1                 PØP     H
                        JRC     MØV1
4015+38F5
4017 210000             LXI     H,0     ;BASIC START
401A 11FF3C             LXI     D,3CFFH ;BASIC END
401D 019040             LXI     B,4090H
4020 0A         MØV2:   LDAX    B
4021 77                 MØV     M,A
4022 23                 INX     H
4023 03                 INX     B
4024 B7                 ØRA     A       ;RESET CARRY
4025 E5                 PUSH    H
                        DSBC    D
4026+ED52
4028 E1                 PØP     H
                        JRC     MØV2
4029+38F5
402B C7                 RST     0       ;STARTUP BASIC
402C                    END

B>
```

Microsoft FORTRAN for CP/M

Review by Alan R. Miller, Contributing Editor

INTRODUCTION

Digital computers consist of many binary memory cells. Each of these cells has only two possible states that can be expressed as: TRUE or FALSE; logic 1 or logic 0; ON or OFF; etc. Many different computer languages have been developed to help programmers convert their ideas into this fundamental binary code.

The programmer encodes concepts into a SOURCE PROGRAM and then uses another computer program to convert this source program into a binary OBJECT PROGRAM that the computer can use. FORTRAN, COBOL, PASCAL, and ALGOL are some of the common computer languages that do this translation.

Each type of computer language is especially suitable for a particular task. A line of a FORTRAN source program such as:

```
Z(I) = SQRT(X(I)**2 + Y(I)**2)
```

may be translated into many lines of computer instructions by a compiler or interpreter. The source program is generally machine independent, so that a sorting program written in BASIC will run on a 6800 microcomputer as well as on an 8080.

In contrast to these high-level computer languages, assembly language is a low-level computer language that is more difficult to use, but produces shorter programs that run faster. And, unlike the higher-level languages, each line of an assembly-language source program will generally produce one computer instruction. Besides being more difficult to use, assembly language has another disadvantage. The source program is usable only with a specific type of computer. This means that a sorting routine written in 8080 assembly language will not run on a 6800 computer.

FORTRAN and BASIC languages are especially suitable for mathematical calculations (compared to COBOL, e.g., which is useful for the handling of business records). These high-level programs utilize a separate processing program to convert the original, user-written source program into the ultimate binary code needed by the computer.

BASIC source programs are commonly processed by a BASIC interpreter that resides in the computer memory along with the user's original source program. Each line of the source program is interpreted as it is encountered. Thus if the instruction:

```
Y(I) = X(I)
```

occurs in a loop that is executed 500 times, the same instruction is interpreted 500 times. Exceptions to this are BASIC-E and CBASIC. For these programs, a preprocessor first converts the source program into an intermediate program, which is then used by a run-time monitor.

ADVANTAGES OF FORTRAN

FORTRAN works a little differently. Each source program is first compiled into a relocatable binary object program. Then a linking loader program places the needed relocatable modules into memory in such a way that they can be run by themselves. No run-time monitor or interpreter need be present. The advantages of FORTRAN compared to BASIC are that less memory is required at run-time and the programs run faster (once they have been compiled) since only the ultimate binary code resides in memory. BASIC requires an 8K to 20K-byte run-time interpreter, as well as the original source code, with all of its comments, to be present in memory. FORTRAN is faster since the source program instructions don't have to be converted each time they are encountered.

A third advantage of FORTRAN, the localization of variables, may be the most important of all. If a subroutine is written to sort an array X of length N, it can readily be used to sort the array Z of length M.

```
DIMENSION X(30),Z(50)
  • •
CALL SORT (Z,M)
  • •
CALL SORT (Z,M)
  • •
SUBROUTINE SORT(X,N)
CIMENSION X(1)
  •
RETURN
```

By contrast, all variables are global in BASIC. This means that the array Z would have to be copied into the array X and N would have to be changed to M before the sort routine could be called a second time:

```
10 DIM X(30),Z(50)
20 M = 50 : N = 30
60 GOSUB 1000 : REM SORT X
100 N = M
110 FOR I=1 TO N
120 X(I) = Z(I)
130 NEXT I
140 GOSUB 1000 : REM SORT Z
 • •
1000 REM SORTING ROUTINE
```

And if the array X were needed later, it would have to be saved by the first copying into another array. Of course, there could be two sort routines, one for X and the other for Z, but this solution seems to be even worse.

Yet another advantage of FORTRAN is that there is a wealth of software available in the mathematics and engineering fields. For example, the IBM Scientific Subroutine Package contains routines for statistical analysis, curve fitting, and simultaneous solution of linear equations.

One of the greatest disadvantages of FORTRAN is that a program cannot be debugged as easily as a BASIC program. Typing a Control-C will stop a BASIC program while it is running. The user can then print the current values of any of the variables and even change the values. The program can then be resumed with a CONT command. This potential problem can be greatly reduced in FORTRAN, however, by programming in modular fashion. Thus an input subroutine, and output subroutine, a sort subroutine, etc., can each be written, compiled, run, and debugged if necessary. These modules can then be called by a main program when needed.

Another possible problem with FORTRAN is that no check is made to see if array indexes are out of range. Consider the following example:

```
DIMENSION X(10),Y(10)
• • •
Y(1) = 5
X(11) = 8
WRITE (1,101) Y(1)
```

The value of Y(1) has been changed from 5 to 8. Y(1) was initially set to 5, but the expression X(11) actually evaluates to 11 locations past the start of X. In this case it is also the address of Y(1). This potential problem is present in almost all versions of FORTRAN.

MICROSOFT FORTRAN

Microsoft, the organization that produced the MITS BASICs, and the TRS Level II BASIC, now offers a disk-based FORTRAN for the 8080 and Z-80 microprocessors. Versions are available for CP/M, Tektronix, ISIS-II, DTC Microfile, and MITS disk operating systems. A net memory size of 24K bytes, in addition to the disk operating system (DOS), is needed for the compiler. The CP/M version is reviewed in this article, but the other versions appear to be similar. The Microsoft CP/M version of FORTRAN is easily implemented since it uses the CP/M DOS primitives for all peripheral operations such as disk, console, list output, etc.

THE MANUALS

Three extensive and well-written manuals are provided with FORTRAN-80:

1. FORTRAN Reference Manual
   Language, grammar, and syntax
2. FORTRAN User Manual
   a. Use of compiler
   b. Run-time error messages
3. Utility Software Manual
   a. Assembler
   b. Linking loader
   c. Library manager
   d. Differences for versions

The total documentation runs for 152 pages and comes in an attractive and useful ring binder.

CREATING A FORTRAN SOURCE PROGRAM

FORTRAN source programs are generated and edited with the regular CP/M context editor:

```
B>A:ED SORT.FOR
```

The default extension is FOR. ANSI Standard FORTRAN X3.1966 is utilized except that there are no complex functions. There are also some additional nice features that are discussed later in this article.

The standard FORTRAN line of 80 characters has the format:

Column 1 - 5	Statement label, a decimal number
Column 7 72-	Statement field
Column 72-80	Identification field

And if the statement is too long:

Column 6	Continuation field (next line)
Column 7 -72	Contiuation of the statement

Comments can be placed between statements:

Column 1	The letter C
Column 2 -72	Text of the comment

USE OF THE ASCII TAB CHARACTER

The ASCII tab (Control-I) can be used to speed up the typing and reduce the size of the source program. Enter the label (line number) first (if any) starting in column 1. Then type a tab followed by the FORTRAN statement. The compiler will interpret the tab as the equivalent number of spaces. Thus:

```
12 <tab> X = 4
```

has the same meaning as:

```
12 <6 blanks> X = 4
```

If you have existing FORTRAN source programs that use blanks instead of tabs, they can be converted by using the substitute command in the CP/M editor:

```
BMS^L          ^Z^L^I^Z
```

(The up-arrow means that the control key is pressed.)

THE ORDERING OF SOURCE STATEMENTS

For subprograms, the first line is a SUBROUTINE, FUNCTION, or BLOCK DATA statement. The next group of statements (and the first group for a main program) are the specification statements. They must appear before any executable statements, and must be in the following order:

```
  EXTERNAL, DIMENSION, REAL, INTEGER, ETC.
COMMON
EQUIVALENCE
DATA
```

The executable statements appear next:

```
A = SQRT(X*X + Y*Y)
IF (I .LT. K) GOTO 28
STOP
```

It is good programming practice to group the format statements after the last executable statement (this will usually be a STOP or RETURN).

```
100  FORMAT(' PARABOLIC FIT')
101  FORMAT(1P6E13.2)
```

The final statement in each program is:

```
END
```

More than one program may be placed into the same file. This would normally be done if there are subroutines used only by one main program, or if one of the subroutines called the others. On the other hand, generaly subprograms such as a sort routine might be called by several different main programs. These then should either be placed into separate files, or combined with several similar routines into a utility library.

ADDITIONAL FORTRAN FEATURES

FORTRAN-80 adds some nice features to the standard ANSI FORTRAN:

1. Logical variables
2. Logical DO-loop indices
3. Mixed-mode arithmetic
4. ASCII strings in expressions
5. Hexadecimal constants
6. Logical operations
7. END= and ERR= in READ and WRITE
8. ENCODE and DECODE
9. PEEK and POKE
10. INP and OUT

FORTRAN considers variables starting with the letters I through N to be integers, and the others to be real, single-precision variables. But this default mode can be over-ridden with specific declarations. Variables can be explicitly declared as one of four types:

LOGICAL	1 byte, with a value of TRUE or FALSE or a number from –128 to 127
INTEGER	2 bytes, –32,768 to 32,767
REAL	4 bytes, 7+ decimal digits 10**–38 to 10**38

DOUBLE PRECISION	8 bytes, 16+ decimal digits; same dynamic range as REAL

There is effectively a fifth type of variable. Any of the above four variables can be used as a STRING variable, with a maximum of one ASCII character per byte.

MIXED MODE

Mixed-mode arithmetic means that an expression such as:

```
Y = 2 * A + 3
```

is allowed, i.e., the decimal points are not needed on the 2 and the 3. Hexadecimal constants can be defined with either an X or a Z:

```
I = Z'FF'     and
J = X'CO'
```

ASCII strings can be defined in three ways: in a data statement, a replacement statement, or a FORMAT statement.

```
      INTEGER TITLE(10)
      DATA TITLE/'NON-','LINE','AR C', 'URVE',' FIT'/
or
      NO = 'NO'
or
      WRITE (1,101)
            • • •
101   FORMAT('PRESSURE VS. TEMPERATURE')
```

The END= option makes it easy to read data without knowing how much there is. The statements:

```
      READ(6,102,END=20)(A(I),I=1,99)
20    N = I - 1
```

can be used to read values into the array A from logical device 6 (a disk for example) until the end-of-file (EOF) mark is encountered. Then the statement, labeled 20, sets the correct number of items read. (Since the EOF mark was also counted, the total must be reduced by one.)

ENCODE and DECODE operations allow the interconversion of ASCII and numeric values, much like the VAL and ASC functions of BASIC. PEEK and POKE allow memory locations to be read or changed. INP and OUT can be used to communicate with peripherals.

COMPILER THE FORTRAN SOURCE PROGRAM

At this point, the FORTRAN source programs have been generated with the CP/M context editor, or copied to a disk file from paper tape using the CP/M PIP program.

We also use a third method. IBM cards are read into our campus central computer and saved on disk files there. A telephone link is then established to our microcomputer using a modem. The FORTRAN files are transferred over the telephone line into our computer memory starting at 100 HEX. The programs are then saved on a floppy diskette by using the CP/M SAVE command.

It is possible, of course, to proceed this far without actually having a FORTRAN compiler, since only the CP/M editor has been used. You might want to do this in anticipation of receiving FORTRAN if you have a large library of programs.

THE ACTUAL COMPILING

Source programs are compiled with the command:

```
F80 =SORT
```

or

```
A:F80 =B:SORT
```

if the compiler is on drive A and the source program is on drive B. Several programs can be more easily compiled with the command:

```
F80
*=SORT
*=C:PPLOT
*=B:CURVFIT
*^C
```

In this case, the compiler prompts each new line with an asterisk. A Control-C is used to indicate the end of the compile session. If there are several subprograms within a single file, the compiler will list the name of each subprogram as it encounters it. The filename need not match any of the subprogram names. If the file contains a main program, the word $MAIN will also appear in the list during the compile procedure.

The compiler produces a relocatable, machine-language program with the same name as the source file, but with the file type of REL. During compilation, two types of error messages may be printed: warning and fatal errors. A warning might occur if a STOP statement were temporarily inserted into the middle of a program during a debugging session:

```
      WRITE (1,101) X
      STOP
      X = 4
```

The compiler will discover that there is no way to reach the statement X = 4 and so issues a warning message. Although this is not a serious problem, the warning message can be avoided by adding the dummy statement:

```
100   CONTINUE
```

after the STOP statement.

A fatal error can occur, for example, if there is an odd number of parentheses in a statement:

```
      Y = A * (B + LOG(C)
```

In this case, it will be necessary to correct the error using the CP/M text editor, then recompile the program with F80.

A FORTRAN LISTING FILE

The FORTRAN compiler can be directed to generate a listing file during the compile process. The switch /L is used for this purpose.

```
F80 = SORT/L
```

This causes an additional file, with the extension PRN to be produced. It contains the original lines of the source program with the corresponding assembly listing of the generated code, interspersed throughout.

The PRN file is useful in debugging a program. It can also be used to increase the efficiency of a frequently used subprogram. In this case, the program is first written in FORTRAN, then compiled with the /L switch. Finally, the PRN file can be used as a guide for writing a more efficient assembly language program.

EXECUTING A FORTRAN PROGRAM

When all of the modules have been successfully compiled, they can be executed with the linking loader:

```
L80  MAIN,SUBR1,SUBR2/G
```

where MAIN, SUBR1, and SUBR2 are the file names of relocatable files. (Each may contain several subroutines.) The standard FORTRAN library routines such as ABS, ATAN, EXP, SIN, etc., are located in a file named FORLIB.REL. If FORLIB resides on the currently logged-in disk, it will be automatically searched for the necessary programs. If, however, the user-written FORTRAN programs are on a different drive from the FORTRAN processing programs, then the process is a little more complicated. The drive names must be included and FORLIB must be specifically listed if it is not on the default drive. For example, the execution command can be:

```
A>L80  B:MAIN,B:MATHLIB/G
```

in case L80 and FORLIB are on the currently logged-in drive A, or

```
B>A:L80 MAIN,MATHLIB,A:FORLIB/S/G
```

if B is the default drive. Notice that the filetype REL is not entered.

The FORTRAN linking loader will automatically find all necessary programs, relocate them in memory, then start execution if the /G switch has been given. The /S switch immediately following FORLIB instructs the loader to search that library for the necessary routines and then load them into memory. If the /S switch is not given, the entire FORLIB library will be loaded into memory.

The absolute memory image can be saved as a disk file of type COM if the /N switch is set. This will allow the program to be more quickly run. But the disadvantage is that the COM file requires relatively large amounts of disk space.

OUTPUTTING THE DATA

At some point in the process, the programmer will want to see at least some of the results of the calculations. This is accomplished in FORTRAN with a WRITE statement.

```
WRITE (LUN,101)  <list>
```

where LUN is the FORTRAN logical unit number specifying the particular peripheral, 101 is the line number of the format statement and <list> is a list of the variables to be written.

Logical unit numbers 1,3,4, and 5 are preassigned to the system console. An LUN of 2 is preassigned to the list device and LUN values of 5 through 10 are preassigned to disk operations. Units 11 through 255 can also be used by the programmer.

During the development of a new program, it would be advantageous to first view the results on the video screen of the system console. This is accomplished by defining the LUN in the WRITE statements to be 1. Then after the program is running satisfactorily, the output can be sent to the line printer so a permanent copy can be obtained. There are several ways in which this can be accomplished.

If the CP/M IOBYTE feature has been implemented, then the program called STAT can be used to reassign the console output to the list device:

```
A>STAT CON:=LST:
```

When the FORTRAN program is executed again, the results will appear at the line printer.

Another method would be to input the LUN from the console near the beginning of the program.

```
      LUN = 1
      WRITE (1,101)
      READ (1,102) NOYES
      IF (NOYES .EQ. 'Y' .OR. NOYES .EQ. 'y') LUN = 2
                  • • •
  101 FORMAT(' OUTPUT TO LINE PRINTER? ')
  102 FORMAT(A1)
```

This routine only looks at the first character that was entered, ignoring the rest. Thus, inputting a YES, a Y or a YUP will send the output to the line printer. Any other answer will send the output to the console.

ABORTING A FORTRAN PROGRAM

Suppose that you would like to generate a stream of random numbers so that the calculated values can be examined. Then at some point, you would like to stop. A Control-C can be used to abort a BASIC program in this case, but FORTRAN has no such option built in. The INP function provided by Microsoft, however, can be used for this purpose. The following routine could be executed after every 100 loops. It is written for a console status port of decimal 16, and a read-ready flat at bit 0, active high.

```
      LOGICAL DONE
                  • • •
      DONE = INP(16)
      DONE = DONE .AND. 1
      IF (DONE) STOP
```

DISK INPUT-OUTPUT

Both sequential and random-disk file access are available in the CP/M version. FORTRAN logical unit numbers 6 to 10 have been preassigned for this purpose. The FORTRAN statement:

```
WRITE (6,101) (A(I),I=1,N)
```

will place the data into a file named FORT06.DAT of the currently logged-in disk.

Alternatively, a more specific method is available. The command:

```
CALL OPEN (6,'NEWDATA ASC',2)
```

will open a file named NEWDATA.ASC on drive B and associate it with logical unit number 6. The first argument defines the logical unit number and must evaluate to an integer. The second argument is the filename. Notice that it is not in the usual CP/M format. In this case, the filename must evaluate a string of exactly 11 ASCII characters and must not contain the usual decimal point between the primary name and the extention. The first eight characters are the primary name and the last three characters are the file type. If the primary filename is shorter than eight characters, as in the above example, the remainder must be filled with blanks.

The third argument of OPEN specifies the disk drive, and must evaluate to an integer. A zero value refers to the default drive and the numbers 1 through 4 explicitly specify drives A through D. Once a file has been opened, it can be read with the command:

```
READ (6,102) (B(I),I=1,N)
```

If data is written to the file with the statement:

```
WRITE (6,105) A,B,C
```

then a new file is created. If a file of the same name already exists, it is erased before the new data is written.

At the end of the disk access, the file should be closed with the command:

```
ENDFILE 6     or
REWIND 6
```

The latter command closes the file, then reopens it. This could be used to write data in one format, then read it back in a different format. (But see the ENCODE and DECODE commands.)

ASSEMBLY-LANGUAGE PROGRAMS FOR FORTRAN

The Microsoft FORTRAN compiler converts the user's source program into a relocatable machine-language program which is in turn converted into binary code. But the resulting binary code may not be as fast or occupy as small a memory space as if it had been originally written in assembly language. The tradeoff is that the FORTRAN source program can generally be written and debugged much more rapidly than if it had been written in assembly language. Nevertheless, for short, frequently used subroutines, it is often advantageous to use assembly language rather than FORTRAN.

The Microsoft FORTRAN package contains a macro assembler that produces compatible, relocatable modules that can be called from FORTRAN programs in the usual way. In fact, the programmer will not generally be concerned with whether the relocatable modules were originally written in FORTRAN or in assembly language.

An assembly language function to generate real random numbers can be written, since such a routine is not provided in the standard library. The algorithm, which appeared in the October 12, 1978, issue of Electronics is used to generate a 24-bit integer (Listing 1).

The low-order 23 bits are copied into the 3-byte mantissa of the FORTRAN floating-point accumulator (at $AC). The 24th (high order) bit is zeroed to make the resulting number positive. The 8-bit exponent is set to 80 HEX to give a resulting range of 0.5 to 1.0. The number is then converted to the usual range of 0 to 1 by using the FORTRAN arithmetic routines. The random number is first multiplied by 2 with the subroutine $MA, then 1 is subtracted with the subroutine $SA.

Notice that the subroutines $MA and $SA are declared as external, as is the location of the floating-point accumulator $AC. Also the subroutine name RND, used by the calling FORTRAN program, is declared to be an entry.

The assembly language random-number generator can be called from a FORTRAN program in the usual way:

```
Y = RND(NSKIP)
```

A real random number between 0 and 1 will be placed into the variable Y. The integer argument instructs the function to skip over NSKIP random numbers before choosing the next number. This argument can be retrieved with a MOV A,M instruction, since the H,L register pair points to the least-significant byte of argument.

THE LIBRARY MANAGER

The CP/M vesion of FORTRAN contains a program called LIB that can be used to build library files of relocatable programs. For example, the relocatable module of the above random-number generator can be incorporated into FORLIB by use of the program LIB. This makes it unnecessary to specifically list the module RND in the link command at execution time.

A SPEED COMPARISON

The Microsoft CP/M version of BASIC is much faster than earlier versions such as 4.1 EXTENDED, and also faster than many of the other 8080 or Z-80 BASICs. A speed comparison was made between Microsoft BASIC and FORTRAN by solving sets of linear equations. The same algorithm, a Householder technique, was coded in both BASIC and FORTRAN. the BASIC statement:

```
DEFINT I-N
```

was used to declare loop variables to be two-byte integers for faster operation. The FORTRAN program consistently produced the solution 8 times faster than the BASIC version (17 seconds vs. 135 seconds for 14 equations).□

PROGRAM LISTING

```
                        ; RND: A FORTRAN-CALLABLE FUNCTION
                        ;      TO GENERATE A RANDOM
                        ;      NUMBER FROM 0 TO 1
                        ;
                        ; METHOD: ELECTRONICS, OCT. 12, 1978
                        ; USAGE:  X = RND(NPASS)
                        ;  NPASS IS THE NUMBER OF TIMES TO SKIP
                        ;
                        ; PROGRAMMED BY ALAN R. MILLER
                        ; NEW MEXICO TECH, SOCORRO 87801
                        ;
0000'                           TITLE   RANDOM-NUMBER GENERATOR
                        ;
0000'                           EXT     $AC,$MA,$SA
0000'                           ENTRY   RND
                        ;
0000'  06 01            RND:    MVI     B,1         ;SET FOR ONE PASS
0002'  7E                       MOV     A,M         ;GET ARGUMENT
0003'  E6 0F                    ANI     0FH         ;TAKE 4 BITS
0005'  CA 0009 '                JZ      NEXTN       ;CHANGE 0 TO 1
0008'  47                       MOV     B,A
0009'  2A 0049 '        NEXTN:  LHLD    WORD2       ;HIGH 2 BYTES
000C'  EB                       XCHG                ;PUT IN D,E
000D'  2A 0047 '                LHLD    WORD1       ;LOW 2 BYTES
0010'  29                       DAD     H           ;SHIFT LEFT
0011'  7B                       MOV     A,E
0012'  17                       RAL                 ;SHIFT LEFT
0013'  5F                       MOV     E,A
0014'  AD                       XRA     L           ;FEEDBACK
0015'  F2 0019 '                JP      SKIP
0018'  23                       INX     H
0019'  22 0047 '        SKIP:   SHLD    WORD1       ;HIGH 1 BYTES
001C'  EB                       XCHG
001D'  22 0049 '                SHLD    WORD2       ;HIGH 2 BYTES
0020'  05                       DCR     B           ;COUNT
0021'  C2 0009 '                JNZ     NEXTN       ;DO IT AGAIN
0024'  21 0000 *                LXI     H,$AC       ;POINT TO FAC
0027'  3A 0047 '                LDA     B1          ;LOW BYTE
002A'  77                       MOV     M,A         ;PUT IN FAC
002B'  23                       INX     H
002C'  3A 0048 '                LDA     B2          ;SECOND BYTE
002F'  77                       MOV     M,A
0030'  23                       INX     H
0031'  3A 0049 '                LDA     B3
0034'  E6 7F                    ANI     7FH         ;BIT 7 PLUS
0036'  77                       MOV     M,A         ;PUT INTO FAC
0037'  23                       INX     H
0038'  36 80                    MVI     M,80H       ;SET EXPONENT
003A'  21 0002                  LXI     H,2
003D'  CD 0000 *                CALL    $MA         ;TIMES 2
0040'  21 0001                  LXI     H,1
0043'  CD 0000 *                CALL    $SA         ;SUBTR 1
0046'  C9                       RET
                        ;
0047'                   WORD1:
0047'  0D               B1:     DB      0DH
0048'  B1               B2:     DB      0B1H
0049'                   WORD2:
0049'  9B               B3:     DB      9BH
004A'  80               B4:     DB      80H
004B'                           END

$AC     0025*   $MA     003E*   $SA     0044*   RND     0000'
NEXTN   0009'   WORD2   0049'   WORD1   0047'   SKIP    0019'
B1      0047'   B2      0048'   B3      0049'   B4      004A'
```

M6800 Program Relocator

By Dr. Gordon W. Wolfe

One of the major advantages of a 6800-based microcomputer is the great amount of software available, either in microcomputer magazines or from the manufacturer or support companies which sell software. Basic interpreters, text editors, assemblers and disassemblers as well as several game and utility programs have all been published and are on the market as well.

One minor problem with software not written by the user is that the program may not reside in a convenient segment of RAM memory. For example, a printer handler may occupy the same memory location as the executive portion of a disassembler (obtained from a different source) requiring a handler for a printer. In order to use the handler to print the results of the disassembly, it will be necessary to have the handler in a usable location.

In the case of a short program like a handler, it would be very easy to re-write the program for a more appropriate place in memory. For longer programs, the program may be re-assembled for a new memory location. This latter option assumes that the user has an assembler program with sufficient memory to accommodate it, and also that the user has a copy of the source program on paper tape or cassette which may be loaded and edited.

Persons having a minimum system, such as the SWTPC 6800 with only 4K of RAM or the MITS 680 with a minimum 1K memory, have insufficient memory to accommodate an assembler/editor. A cassette interface or paper tape read/punch is virtually a necessity for a microcomputer user, but many people may not have one. In addition, some programs are available only in machine language form.

The following program will transfer a block of data or a machine-language program from one location to another and allow it to remain executable in the new location. For example, if the program to be moved is in location 1200-1400 and a particular 3-byte instruction, say at HEX address 1380, is STX $1250 (FF 1250), the instruction will reside at HEX address 0580 after transfer to location 0400-0600, and will be FF 0450 in machine language.

This program was written for the SWTPC 6800. The system used has 12K of memory, a CT-1024 terminal, and AC-30 cassette interface. The SWTPC 6800 has scratchpad memory at HEX addresses A000 to A07F, control interface at HEX locations 8004 to 8007, and MIKBUG ROM monitor occupying the upper 8K of memory above location E000.

The program described here makes use of the scratchpad memory and uses four routines in MIKBUG. There is a provision in the program that 3-byte instructions containing addresses of the interfaces, the scratchpad, or MIKBUG will be transferred with these addresses unchanged so that addresses or routines in these areas may be referenced by the transferred program.

USING THE PROGRAM

The relocator program may be used on machine-language programs resident in RAM at HEX addresses 7FFF or lower (to avoid conflicts with scratchpad, interfaces, or the monitor) or on HEX data resident anywhere in the machine. It will not transfer both in one operation. If a program contains character or HEX data within the body of the program, each block of program or data must be relocated in a separate move. For example, the program may be used to relocate itself but will require two operations, one for the data from HEX locations 0E80 to 0EAF, and a separate one for the program proper located between 0EB0 and 0F56.

To use the program, do the following:

1. Load the program.
2. Use the MIKBUG memory change function to set the program counter, addresses A048 and A049, to 0EB0, the start address of the relocator program.
3. From the MIKBUG monitor, type "G" to begin execution. The program will prompt with a carriage return, line feed, "?", and a space.
4. Type a "P" for program segment or a "D" for data segment to be transferred. The computer will respond with a space.
5. Enter (in hexadecimal) the start address of the program or data block to be transferred, the old end address, and the new start address. The computer will put spaces between each. Transfer is completed when the prompt is re-displayed. Additional segments may be transferred by returning to step 4.

HOW IT WORKS

Hexadecimal data is simply transferred byte-by-byte from the old location to the new.

Program transfers make use of an interesting fact about the 6800 instruction set; the most significant 4 bits of the opcode define the total number of bytes in the instruction. (See Table 1.) If the opcode is represented by a two-character hexadecimal number, say 20 for Branch Always, which is a two-byte instruction, all opcodes beginning with the HEX number two will be two-byte instructions. All opcodes beginning with seven, such as 7E (Jump Extended), are 3-byte instructions where the second and third byte are an address (the Jump address). One-byte instructions are inherent operations and are merely transferred to the new location.

Table 1.

First 4 Bits of OPCODE (HEX)	No. Bytes	Address Mode
0	1	Inherent
1	1	Inherent
2	2	Relative
3	1	Inherent
4	1	Inherent
5	1	Inherent
6	2	Indexed
7	3	Extended
8	2 or 3	Immediate or Relative
9	2	Direct
A	2	Indexed
B	3	Extended
C	2	Immediate
D	2	Direct
E	2	Indexed
F	3	Extended

Two-byte instructions are also transferred byte-by-byte to the new location. The first byte is the opcode, and the second is a relative or direct address which will remain unchanged in the transfer or immediate data, also unchanged.

In the case of 3-byte instructions, the opcode is transferred first. Then the address is tested to see if it is 7FFF or less. If the second two bytes are less than 7FFF, a new address is calculated by adding the difference between the new start address and the old start address to the second two bytes of the instruction. If the second two bytes are 8000 or greater, no new address is calculated. The second two bytes are then transferred.

Note that opcodes beginning with HEX 8, such as 8A (OR

Note that opcodes beginning with HEX 8, such as 8A (ORA A), may be either 2- or 3-byte instructions. The program will test for this and execute the appropriate transfer routine.

Table 2.

Address	Name	Called from ADDR	Purpose
E07E	PDATA1	0EB3	Outputs character string pointed to by index register, terminated by HEX 04.
E1AC	INEEE	0EB6	Inputs ASCII character to A accumulator
E047	BADDR	0EBF	Inputs 4 HEX characters and stores them in index register
		0EC8	
		0ED1	
E0CC	OUTS	0EBC	outputs a space
		0EC5	
		0ECE	
A002-A003		0EC2	Storage location of old start address
		0EDD,0EE0	
		0EF4	
		0F0A	
		0F19	
		0F27	
		0F33	
A004-A005		0ECB	Storage location of old end address
		0F2A	
A014-A015		0ED4	Storage location of new start address
		0ED&,0EDA	
		0F1E	
		0F24	
A016-A017		0EE3,0EE6	Storage location of transfer vector
		0F4B,0F4E	

ADAPTING THE PROGRAM RELOCATOR

Table 2 shows the addresses in scratchpad and MIKBUG and the location of their calls, as well as the purpose of the memory location or subroutine.

If a particular machine does not use MIKBUG, routines must be supplied to take the place of MIKBUG's routines PDATA1, INEEE, BADDR, and OUTS. The calls to these routines should be changed to reflect the location of the routines. If an assembler is available, this is accomplished most easily by changing the EQU statements at the beginning of the programs and re-assembling.

Table 3. System Requirements

NAME:	BLKXFER
FUNCTION:	Move program or data block from one memory location to another, retaining executability of program in new location.
RESULTS:	New program is produced in different memory location.
HARDWARE CONFIGURATION:	SWTPC 6800 microprocessor, CT-1024 TV terminal, AC-30 cassette interface.
MEMORY REQUIRED:	Program resides in $0E80 to $0E56. Scratchpad memory required from $A002 to $A017. Memory also required for program in initial and final storage locations.
SOFTWARE SUPPORT:	MIKBUG
ASSEMBLER:	Motorola Co-Resident Assembler

MIKBUG's scratchpad RAM in location A000 to A07F is also used for temporary storage in BLKXFER. If a machine does not have RAM at this location, temporary storage must be placed in RAM. There is sufficient storage for this purpose in the reserve memory bytes area between 0EA6 and 0EAF.

Lastly, BLKXFER will not recompute addresses higher than 7FFF. This upper limit may be changed to any 256-byte block by changing the data for the compare immediate instruction at HEX address 0F40.□

ASSEMBLY LISTING

```
0001                            NAM     BLKXFER
0002 E07E           PDATA1      EQU     *
0003 E1AC           INEEE       EQU     *
0004 E047           BADDR       EQU     *
0005 E0CC           OUTS        EQU     *

0006                            ORG     $0E80

0007 0E80 0F19      TABLE       FDB     $0F19   TABLE OF OPCODE FIRST HEX
0008 0E82 0F19                  FDB     $0F19   CHARACTER: SUBROUTINE
0009 0E84 0F37                  FDB     $0F37   ADDR FOR DATA TYPE
0010 0E86 0F19                  FDB     $0F19
0011 0E88 0F19                  FDB     $0F19
0012 0E8A 0F19                  FDB     $0F19

0013 0E8C 0F37                  FDB     $0F37
0014 0E8E 0F3C                  FDB     $0F3C
0015 0E90 0F0A                  FDB     $0F0A
0016 0E92 0F37                  FDB     $0F37
0017 0E94 0F37                  FDB     $0F37
0018 0E96 0F3C                  FDB     $0F3C
0019 0E98 0F37                  FDB     $0F37

0020 0E9A 0F37                  FDB     $0F37
0021 0E9C 0F37                  FDB     $0F37
0022 0E9E 0F3C                  FDB     $0F3C
0023 0EA0 0D        CRLF        FCB     $0D     OUTPUT PROMPT
0024 0EA1 0A                    FCB     $0A
0025 0EA2 3F20                  FCC     /? /
0026 0EA4 04                    FCB     $04
0027 0EA5 000B      TYPE        RMB      B      WORK SPACE

0028 0EB0 CE 0EA0   START       LDX     #CRLF   PROGRAM START
0029 0EB3 BD E07E               JSR     PDATA1  OUTPUT PROMPT
0030 0EB6 BD E1AC               JSR     INEEE   INPUT DATA TYPE
0031 0EB9 B7 0EA5               STA A   TYPE
0032 0EBC BD E0CC               JSR     OUTS
0033 0EBF BD E047               JSR     BADDR   INPUT OLD START ADDR
0034 0EC2 FF A002               STX     $A002
0035 0EC5 BD E0CC               JSR     OUTS
0036 0EC8 BD E047               JSR     BADDR   INPUT OLD END ADDR
0037 0ECB FF A004               STX     $A004
0038 0ECE BD E0CC               JSR     OUTS
0039 0ED1 BD E047               JSR     BADDR   INPUT NEW START ADDR
0040 0ED4 FF A014               STX     $A014
0041 0ED7 B6 A015               LDA A   $A015   COMPUTE TRANSFER VECTOR
0042 0EDA F6 A014               LDA B   $A014
0043 0EDD B0 A003               SUB A   $A003
0044 0EE0 F2 A002               SBC B   $A002
0045 0EE3 B7 A017               STA A   $A017
0046 0EE6 F7 A016               STA B   $A016
0047 0EE9 F6 0EA5   LOOP        LDA B   TYPE    PROGRAM OR DATA?
0048 0EEC C1 44                 CMP B   #$44    D?
0049 0EEE 27 B6                 BEQ     TYPED   GO TO DATA ROUTINE
0050 0EF0 C1 50                 CMP B   #$50    P?
0051 0EF2 26 BC                 BNE     START   IF NEITHER, START OVER
0052 0EF4 FE A002               LDX     #$A002
0053 0EF7 A6 00                 LDA A   0,X     GET MOST SIGNIFICANT 4 BITS
0054 0EF9 44                    LSR A           OF OPCODE
0055 0EFA 44                    LSR A
0056 0EFB 44                    LSR A
0057 0EFC 44                    LSR A
0058 0EFD 48                    ASL A           MULTIPLY BY 2
0059 0EFE B7 0F05               STA A   $0F05   LOOK UP ADDR FOR OPCODE TYPE
0060 0F01 CE 0E80               LDX     #TABLE
0061 0F04 EE 00                 LDX     0,X
0062 0F06 AD 00                 BSR     0,X     GO TO OPCODE TYPE SUBROUTINE
0063 0F08 20 DF                 BRA     LOOP    NEXT INSTRUCTION
0064 0F0A FE A002   TYPE8       LDX     $A002   OPCODE=8X, SEE IF 2 OR 3 BYTE
0065 0F0D A6 00                 LDA A   0,X     INSTRUCTION
0066 0F0F 81 8C                 CMP A   #$8C
0067 0F11 27 29                 BEQ     TYPE3
0068 0F13 81 8E                 CMP A   #$8E
0069 0F15 27 25                 BEQ     TYPE 3
0070 0F17 20 1E                 BRA     TYPE2   2 BYTES
0071 0F19 FE A002   TYPE1       LDX     $A002   TRANSFER 1-BYTE INSTRUCTION
0072 0F1C A6 00                 LDA A   0,X     OR DATA WIHTOUT CHANGE
0073 0F1E FE A014   TYPEA       LDX     $A014
0074 0F21 A7 00                 STA A   0,X
0075 0F23 08                    INX
0076 0F24 FF A014               STX     $A014
0077 0F27 FE A002   INCRX       LDX     $A002
0078 0F2A BC A004               CPX     $A004   END OF DATA?
0079 0F2D 26 03                 BNE     END1    NO
0080 0F2F 7E 0EB0               JMP     START   YES
0081 0F32 08        END1        INX
0082 0F33 FF A002               STX     $A002
0083 0F36 39                    RTS
0084 0F37 8D E0     TYPE2       BSR     TYPE1   TRANSFER 2-BYTE INSTRUCTION
0085 0F39 8D DE                 BSR     TYPE1   WITH NO CHANGE
0086 0F3B 39                    RTS
0087 0F3C 8D DB     TYPE3       BSR     TYPE1   3 BYTES: TRANSFER OPCODE
0088 0F3E A6 00                 LDA A   0,X
0089 0F40 81 7F                 CMP A   #$7F    IN RAM?
0090 0F42 23 05                 BLS     MORE     YES
0091 0F44 8D D3                 BSR     TYPE1   NO-TRANSFER ADDR UNCHANGED
0092 0F46 8D D1                 BSR     TYPE1
0093 0F48 39                    RTS
0094 0F49 E6 01     MORE        LDA B   1,X     COMPUTE NEW ADDR
0095 0F4B FB A017               ADD B   $A017
0096 0F4E B9 A016               ADC A   $A016
0097 0F51 8D CB                 BSR     TYPEA   TRANSFER IT
0098 0F53 17                    TBA
0099 0F54 8D C8                 BSR     TYPEA
0100 0F56 39                    RTS
0101                            END
```

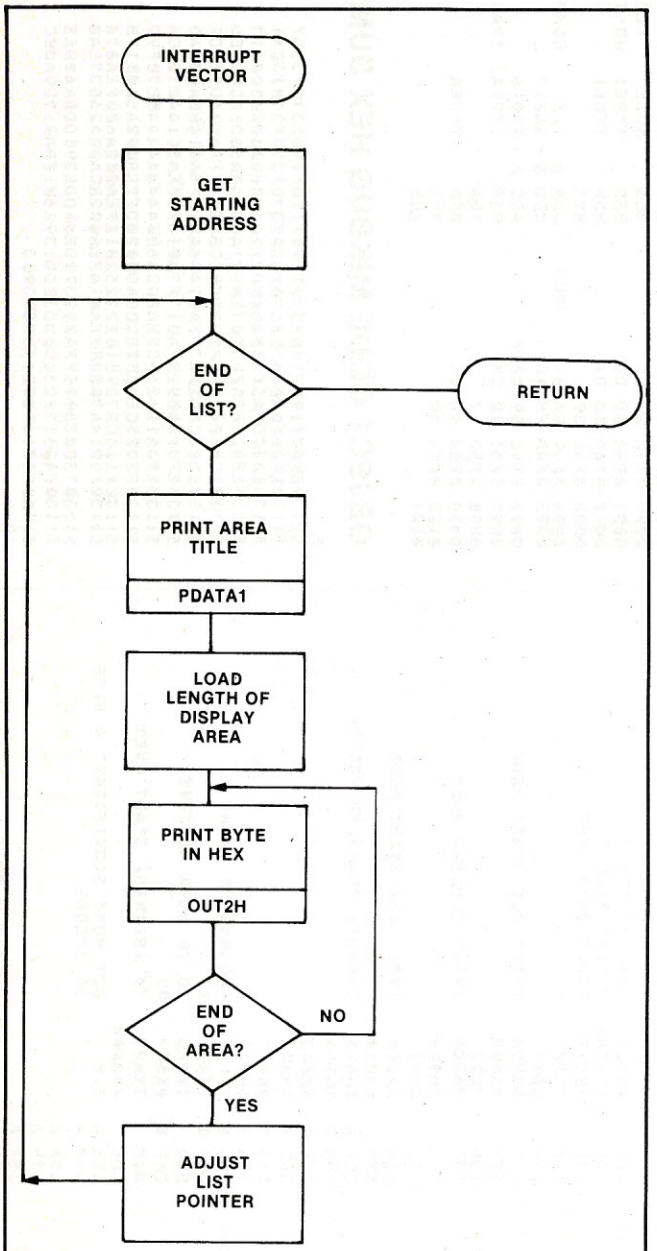
OBJECT CODE MIKBUG HEX DUMP

```
P
S1130E800F190F190F370F190F190F190F370F3CBF
S1130E900F0A0F370F370F3C0F370F370F370F3C41
S1130EA00D0A3F2004508D71203F0000000000017
S1130EB0CE0EA0BDE07EBDE1ACB70EA5BDE0CCBDBD
S1130EC0E047FFA002BDE0CCBDE047FFA004BDE0C9
S1130ED0CCBDE047FFA014B6A015F6A014B0A00343
S1130EF0F2A002B7A017F7A016F60EA5C14427B6C4
S1130EF0A15026BCFEA002A6004444444448B70F97
S1130F0005CE0E80EE00AD0020DFFEA002A600811B
S1130F108C2729818E2725201EFEA002A600FEA074
S1130F2014A70008FFA014FEA002BCA00426037EA0
S1130F300EB008FFA002398DE08DDE398DDBA600EE
S1130F40817F23058DD38DD139E601FBA017B9A08C
S10A0F50168DCB178DC83983
S9
*
```

6800 MIKBUG DUMP

By Tom Munnecke

How often have you wished you could look at certain areas of memory at strategic times when debugging an assembler program? This 33-byte program allows you to do just that on 6800 systems using the MIKBUG™ monitor.



Flowchart of DUMP program.

The program uses a display list to define strategic locations in memory by name, length and address. Whenever the routine is invoked, it displays the pertinent data, then returns to let your program continue.

A display list could cause the following display:

COUNT=44,MASK=01,LAST=E1AC,NEXT=0012

You can call the program directly, or you can drive it with an external interrupt. In order to use interrupts:

1. Use the RTI instruction at location A059
2. Set 'A050' into locations A000-A001.
3. Make sure the interrupt flag is clear in your program. If in doubt, execute a 'CLI' instruction.
4. If you do not have an interrupt button on your system, you can force an interrupt by momentarily connecting a wire between the IRQ pin on the MPU (pin 4) or the system bus, and ground.

After you set up your display list according to the formats shown in Figure 3, set memory locations A078-A079 to point to the beginning of the list.

Display List Format:

Descriptor 1	Descriptor 2		Descriptor N	ETX

Any number of descriptors may be in list. List is terminated by ASCII ETX character (HEX '04') after last descriptor. This list is pointed to by location A078.

Figure 1.

Each Descriptor is of the format:

NAME	ETX	LEN	ADDR

Where

1. Name is a string of ASCII characters of any length to be printed before the memory is displayed.
2. ETX (HEX '04') delimits the end of the Name field.
3. LEN is a 1-byte count of the number of bytes of memory to be displayed.
4. ADDR is a 2-byte address of the area to be displayed.

Figure 2.

Example: Print the following when DUMP is executed.

MASK=XX COUNT=YYYY
NAME=ZZZZZZZZZZZZZZZZZZZZ

Where XX is the value of location 003F and YY is the value of location 0100. ZZZZZZZZZZZZZZZZZZZZ is the data stored in location 0020 through 0033.

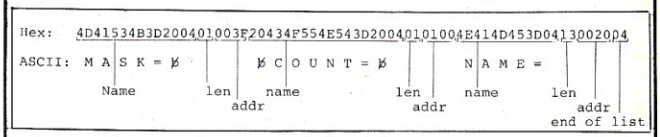


Figure 3.

Since the program uses only relative addressing, it may be located anywhere in memory.□

PROGRAM LISTING

```
00001                          NAM       DUMP
00002                       * 11/17/77 BY TOM MUNNECKE
00003                       * DUMP SELECTED PORTIONS OF
00004                       * MEMORY WITH TITLES.
00005                       *
00006                       * DISPLAY LIST POINTED TO
00007                       * BY A078 CONTROLS FORMATS
00008                       *
00009                       * THIS PROGRAM USES THE
00010                       * MIKBUG (TM MOTOROLA)
00011                       * ROUTINES PDATA1 AND OUT2H
00012                       * TO PRINT ASCII STRINGS
0013                       * (DELIMITED BY ETX) AND A
00014                       * BYTE IN HEX, RESPECTIVELY.
00015                       * THE INDEX REGISTER POINTS TO
00016                       * THE DATA AND IS ADJUSTED BY
00017                       * THE ROUTINES TO POINT TO THE
00018                       * NEXT BYTE BEYOND WHAT WAS
00019                       * PRINTED WHEN THEY RETURN.
00020                       *
00021                       *
00022                          OPT       S,P
00023          A078         START  EQU       $A078
00024          E07E         PDATA1 EQU       $E07E
00025          E0BF         OUT2H  EQU       $E0BF
00026          A07A         SAVE   EQU       $A07A
00027 A050                     ORG       $A050
00028                       *
00029 A050 FE A078 DUMP   LDX       START     GET START ADDR
00030 A053 A6 00   LOOP   LDA A     0,X       GET FIRST BYTE
00031 A055 81 04          CMP A     #$04      END OF LIST ?
00032 A057 26 01          BNE       MORE      NO, GET MORE
00033 A059 39             RTS                 END RETURN TO CALLER
00034                       *
00035                       * RTS CAN BE RTI IF FROM A
00036                       * INTERRUPTED ROUTINE
00037                       *
00038 A05A BD E07E MORE   JSR       PDATA1    PRINT NAME
00039 A05D E6 01          LDA B     1,X       GET LENGTH
00040 A05F FF A07A        STX       SAVE      SAVE CURR POSITION
00041 A062 EE 02          LDX       2,X       GET ADDR TO DISPLAY
00042 A064 BD E0BF HEX    JSR       OUT2H     BUMP BYTE
00043 A067 5A             DEC B               DECREMENT LENGTH CTR
00044 A068 26 FA          BNE       HEX       DUMP NEXT
00045 A06A FE A07A        LDX       SAVE      RESTORE LIST POS.
00046 A06D 08             INX                 ADJUST LIST POSITION
00047 A06E 08             INX                 TO NEXT POSITION IN
00048 A06F 08             INX                 LIST
00049 A070 08             INX
00050 A071 20 E0          BRA       LOOP      PROCESS NEXT
00051                          END

START  A078
PDATA1 E07E
OUT2H  E0BF
SAVE   A07A
DUMP   A050
LOOP   A053
MORE   A05A
HEX    A064

ENTER PASS

S00B000044554D502020203E
S11EA050FEA078A6008104260139BDE07EE601FFA07AEE02BDE0BF5A26FAFE71
S10BA06BA07A0808080820E0AF
S9030000FC
```

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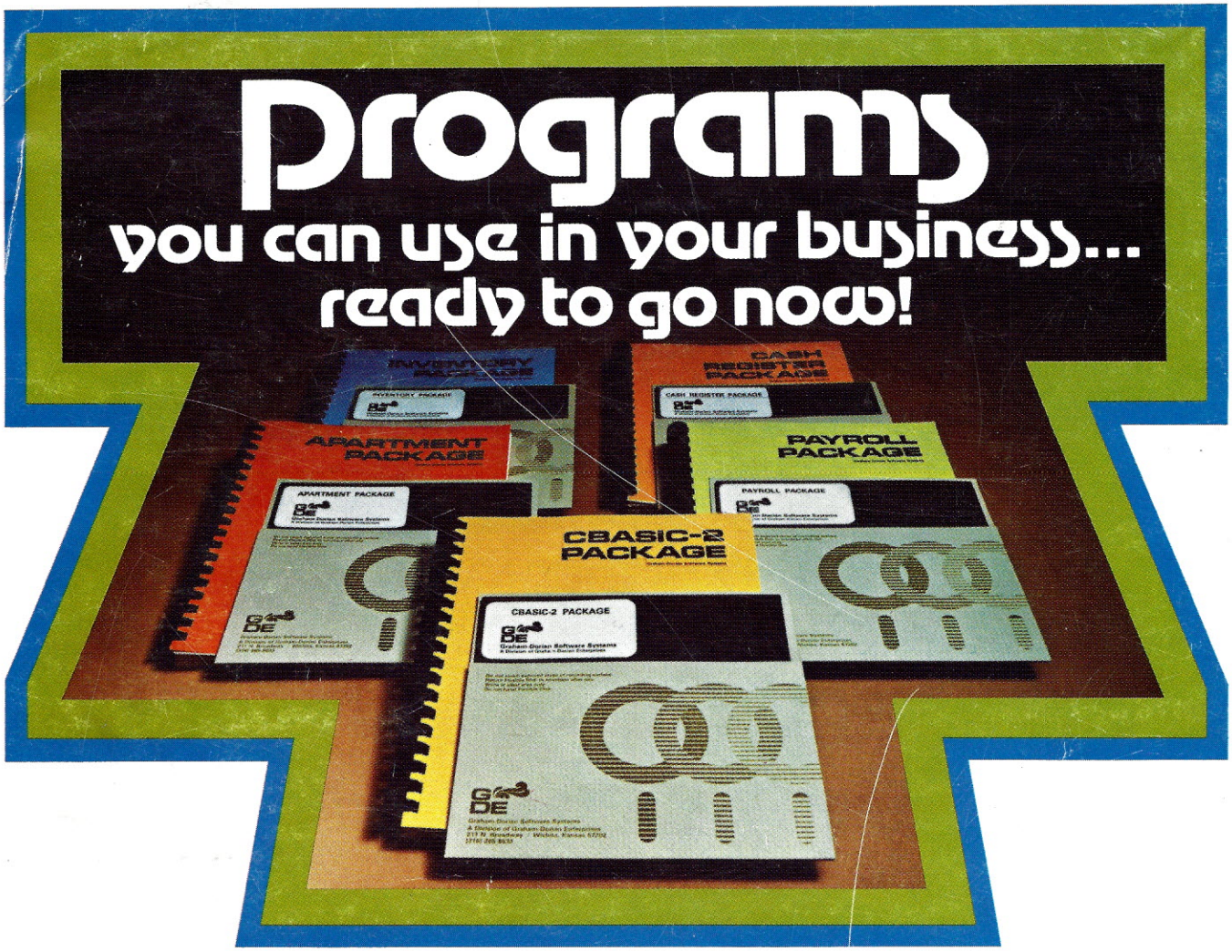

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